SCIENCE

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MSS. intended for publication and books, etc., intended for review should be sent to the responsible editor, Professor J. McKeen Cattell, Garrison-on-Hudson, N. Y.

THE NATIONAL OBSERVATORY QUESTION IN ITS LATEST PHASE.

THE newspapers have announced, we suppose on good authority, that Captain Colby M. Chester, U. S. N., has been selected as Superintendent of the Naval Observatory. It seems from these dispatches that the position is recognized as the most attractive and desirable in the gift of the Navy Department, and is tendered to an officer whose professional abilities and personal character are of so high a class as to render him eminently worthy of the reward. On the old theory that offices are rewards of merit, the action of the Department will doubtless meet general approval. And yet, the abnormality of the situation is such that we hope not to weary our readers if we summarize its principal features.

1. The institution in question is, notwithstanding its name, the national observatory of the United States. It has no rational purpose of existence except a desire on the part of the American people that our nation shall, in its public capacity, do its full share in the promotion of those branches of astronomy which have to be pursued under public auspices. The lead-

ing position which our country has taken in the extraordinary development of astronomic science during our generation can alone justify the unparalleled expenditure of our government upon its observatory.

2. The results of this expenditure through the ten years since the completion of the new observatory should have been its general recognition as the leading observatory of the world in at least some important field of the sciences. With its great advantages over old-fashioned Greenwich and Paris, it should have left both these institutions in the rear.

3. Has it done anything of this kind? Is any work of prime importance in astronomic science being pursued? Do the astronomers of our own or any other country set that high price upon its output which it should command in the world of science? The claim has been made over and over by authorities too high to be ignored that these questions must be answered in the negative. The only official rejoinder to them which we can find is a very free use by the head of the observatory of such terms as 'malice,' 'animosities' and 'prejudices' in his recent annual reports. Did the criticisms in question allege overt wrong-doing, this sort of defence might be more or less in place. But a better defence to the charge that the observatory has been doing nothing of importance would be the showing of something important that it has done.

4. The conduct of the institution can add nothing to the efficiency of the naval service, and must subtract from rather than add to its high character in the eyes of the world. The very appellation 'naval' is a misnomer.

5. The idea that even the best officer in the navy, which the new appointee may well be, can take up the present ill-organized institution, with its imperfect and often antiquated instruments, and its absence of definite aim, and lead the astronomical force on to that position which the establishment should assume in the world of science, is one that cannot be entertained by any impartial reviewer of the situation.

Under these circumstances, should the body of astronomers who desire to make their national institution a worthy representative of their science relax their efforts to bring this result about? Were there any doubt as to the reasonableness and justice of their cause—could even the show of a case against their view be made—they might well abandon their efforts in despair. But when the system against which they contend is so injurious to the good name of American science, and at the same time completely indefensible as it seems to us to be, patriotism and a due regard for the dignity of their science will not allow us to doubt that ultimately success must attend their efforts.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE. SECTION C, CHEMISTRY.

The meetings of Section C of the American Association for the Advancement of Science were held in common with those of the American Chemical Society from June 30 to July 3. The meeting place was the chapel of the Bellefield Presbyterian Church, Pittsburgh. During the first two days the meetings were in charge of the

officers of the American Chemical Society, and under the presidency of Dr. Ira Remsen. On July 2 and 3, Vice-president Dr. H. A. Weber, of Ohio State University, presided.

Of the sixty-nine papers which were announced, fourteen were upon subjects relating to industrial chemistry, thirteen were in the domain of physical chemistry, thirteen were devoted to organic, five to inorganic and twelve to analytical chemistry. Among the papers presented were the following:

Arsenic Pentachloride: CHAS. BASKERVILLE and H. H. BENNETT. Abstract published in the issue of SCIENCE for August 8.

Preparation of Pure Præseodymium Compounds: CHAS. BASKERVILLE and J. W. TURRENTINE. Abstract published in the issue of SCIENCE for August 8.

The Deportment of Pure Thorium and Allied Elements with Organic Bases: CHAS. BASKERVILLE and F. H. LEMLY.

The Chlorids of Ruthenium: JAS. LEWIS HOWE.

Until a few years ago, the only known chlorid of ruthenium was of the type $RuCl_3$, 2R'Cl. Claus's tetrachlorid was shown by Joly to be a nitroso-chlorid, of type $RuCl_3NO$, 2R'Cl. Several years since Antony described a tetrachlorid, $RuCl_4$, 2KCl. At the last meeting the author described the cesium and rubidium salts of the types $RuCl_4$, 2R'Cl, RuO_2Cl_2, 2R'Cl and $RuCl_3H_2O$, 2R'Cl. The method of forming this latter, called an 'aquo'-salt, was not then known. It has now been found that the salts of this 'aquo' series are formed by boiling the salts of the type $RuCl_3$, R'Cl, with alcohol and dilute HCl. These are dehydrated at 180°–200°, giving salts of an isomeric $RuCl_3$, 2R'Cl, differing greatly from the ordinary $RuCl_3$, 2R'Cl in properties. They become hydrated again on treatment with water. The 'aquo' salt, on addition of chlorin, gives the tetrachlorid. $RuCl_4$, 2KCl is a black salt with greenish tint, very soluble and instantly decomposed by water, differing entirely from the salt described by Antony. Using Antony's method, no salt higher than the trichlorid could be obtained, but a hydrated salt, $RuCl_3$, 2KCl, H_2O, differing from the 'aquo' salt was found. This is probably identical with that described by Miolati.

By the action of stannous chlorid on ruthenium trichlorid beautiful red isometric octahedra were obtained, which contained ruthenium, tin, chlorin and an alkali, and in which the ratio of ruthenium to tin is 1 : 12.

An Explanation of Valence and Stereochemistry: THEODORE W. RICHARDS.

Attention was called to the fact that the valence of an element is probably connected with its compressibility, since in general the greater the compressibility, the less is the valence. It was shown that this relationship is easily explained with the help of the hypothesis assuming that atoms are compressible and elastic throughout their whole substance (Richards, *Proc. Am. Acad.*, 37, 1, 1901; 399, 1902; *Zeitschr. Phys. Chem.*, 40, 169, 597, 1902). The carbon atom, with small atomic volume and compressibility would naturally possess high valence, and four larger atoms on combining with it would distort it into the tetrahedron demanded by the theory of van't Hoff and Le Bel. The disposition of the four added atoms on the *faces* instead of the *points* of the tetrahedron thus formed would of course make no difference in the geometric relation. If the four added atoms were all different, they would cause an asymmetric distortion of the carbon atom. The electrical relations of valence were purposely omitted from the discussion.

These and other aspects of the question will receive consideration in the more complete paper soon to be published in the *Proceedings of the American Academy* and the *Zeitschrift für physikalische Chemie.*

The Exactness of Faraday's Law: T. W. Richards.

After reviewing work done in cooperation with E. Collins and G. W. Heimrod (which showed that Faraday's law holds with great accuracy for aqueous solutions and ordinary temperatures), the speaker described some more recent work done with the assistance of W. N. Stull. The weight of silver deposited in the 'porous cup voltameter' of Richards and Heimrod was compared with the weight deposited by the same current from a solution of argentic nitrate in fused sodic and potassic nitrates at 300°. After taking several precautions which cannot be described here, and subtracting the weights of alkaline nitrates included in the silver crystals, it was found that the weights were identical within the limits of error of the experiment (about 0.005 per cent.). This investigation places Faraday's law among the most exact and invariable of the laws of nature.

The Electrical Conductivity and Freezing Points of Aqueous Solutions of Certain Metallic Salts of Tartaric, Malic and Succinic Acids: O. F. Tower.

In an article about two years ago it was shown that the molecular conductivity of aqueous solutions of the tartrates of nickel and cobalt was very low, and also that the freezing point lowerings yielded molecular weights greater than those calculated from the simple formulas. These results have been confirmed and similar determinations made with the tartrates of magnesium, barium and manganese, and the malates and succinates of nickel, cobalt and magnesium. The results show that magnesium tartrate acts, as it may be termed, normally. The tartrates of barium and manganese give results but little different from those of magnesium tartrate. Nickel and cobalt malates yield results considerably different from those of magnesium malate, but the difference is not so great as between the tartrates of the same metals. The succinates of nickel and cobalt act not greatly different from magnesium succinate. The malates and tartrates of nickel and cobalt seem to be polymerized in aqueous solution, the malates, however, less so than the tartrates. The polymerizing influence is dependent on the presence of an hydroxyl group in the acid radicle, and this influence is stronger the greater the number of these groups present.

A Thermochemical Constant: F. W. Clarke.

The author has studied the heats of combustion of organic compounds, as determined by Thomsen. These data represent substances burned as gas, with production of gaseous carbon dioxide and *liquid* water. By a simple correction applied to the last-named factor all the equations of combustion may be reduced to the gaseous form throughout, under uniform conditions of temperature and pressure. So adjusted, by application of a definite formula, nearly every equation yields a constant which is identical in value with the neutralization constant of strong acids and gases. The average, in 66 cases, is 13,773 small calories. From this constant, and the original equations, the conclusion is reached that the *absolute* heat of formation, from gaseous, dissociated atoms, of the aliphatic hydrocarbons and their simpler derivatives, is proportional to the number of atomic linkings within the molecule. In this calculation every linking counts as one, and single, double or triple unions between carbon atoms become identical as regards their thermal value. The conclusion is revolu-

tionary, but it represents a satisfaction of the equations, which are otherwise indeterminate. The preliminary paper contains sixty-six verifications of the new law.

On Conductivity: GEO. A. HULETT.

1. Advantages of saturated solutions as a basis for conductivity of electrolytes.

2. The values for saturated solutions of gypsum are of the correct magnitude for determining the capacity of conductivity cells, and have been proposed by Kohlrausch, but his results are affected by surface tension.

3. Definiteness and reproducibility of normally saturated solutions, and the equation

$$(\lambda_t = .002206 + .0000456\,(t-25) + .000000163\,(t-25)^2)$$

for normally saturated solutions from 10° to 30° calculated from observed data.

4. Sources of error in the Arrhenius cells and water conductivity.

Beziehung zwischen osmotischem Druck und negativem Druck (Relation between Osmotic Pressure and Negative Pressure): GEORGE A. HULETT.

1. It will be necessary here to go somewhat into detail concerning the important property of liquids known as negative pressure (or better perhaps, tensile strength of liquids) reviewing the work of Berthelot (*An. chim. phys.* (3), 30, 232), Worthington (*Phil. Trans.*, 1893), Jolly and Nixon.

2. The dissolved substance, under the influence of osmotic pressure, diffuses to the boundary of the solvent, where it first finds 'foothold' and exerts a pressure normally to the surface equal to the osmotic pressure, and this is a negative pressure on the solvent since it tends to increase the volume of the solvent. This pressure is resisted by the tensile strength of the solvent (which has been measured directly by Worthington and Hulett).

3. A solution in equilibrium with its vapor must then be considered as a system with *unequal* pressures on the two phases. The vapor is subjected only to its own equilibrium pressure, while the liquid is subjected to a very considerable negative pressure (equal to the osmotic pressure).

Such a system, considered from the standpoint of thermodynamics, shows a relation between the negative pressure, molecular volume of the solvent and volume occupied by a gram molecule of the vapor, $\left(\Delta = \frac{P\varphi}{v}\right)$. This shows *why* osmotic pressure lowers the vapor pressure, while the van't Hoff equation $\Delta = \frac{RT^2}{\lambda}$ shows only that Δ is proportional to RT^2 and $1/\lambda$, and it seems that this is only indirectly proportional.

4. Calculation by means of the equation from known data, of the change of vapor pressure due to a given osmotic pressure and comparison with the known changes.

5. The experimental work consists in the direct observation of change of vapor pressure when negative pressure is applied *mechanically* to the liquid alone, with a brief description of the apparatus.

The Expansion of a Gas into a Vacuum and the Kinetic Theory of Gases: PETER FIREMAN.

The expansion of a gas into a vacuum is accompanied by no change of energy. If, however, the experiment is carried out by means of two communicating vessels of equal size, one containing a gas under a given pressure and the other being vacuous, then, on allowing the gas to enter into the vacuous vessel, we observe a rise of temperature in the latter and an equal fall of temperature in the former. Why so? A plausible explanation would be perhaps this: As soon as a little of the gas has entered the empty vessel the rest of the gas will do work on it, causing a rise of the tem-

perature in one and a simultaneous lowering in the other vessel. Such an explanation, however, is unsatisfactory. How can elastic particles (molecules) do work on elastic particles? From the impacts of elastic molecules at a given temperature but with all degrees of velocity, there can result nothing other than all degrees of velocity with the same temperature (only the mean free path would become greater, but this does not affect the velocities). Why then the change of temperature? In my opinion the reason is as follows:

Consider the first molecules near the opening into the vacuous vessel. Suppose a very quick molecule enters into the vacuum; it will retain its high velocity. Suppose further a slow molecule enters into the empty vessel, it will soon be overtaken by a quick one and exchange velocities (according to the law of impacts between elastic bodies) with it. In brief, for a short time there will be, in the empty vessel, only quick molecules, and consequently in the other vessel only slow ones. We have here, as it were, a separation (fractionally) into quick and slow molecules which causes the observed changes of temperature.

The Use of Potassium-ferric Chloride for the Solution of Steel in making the Determination of Carbon: Geo. Wm. Sargent.

Ferric chloride reacts upon the steel drillings according to the equation: $Fe + 2FeCl_3 = 3FeCl_2$. The reaction takes place best as in the case of the copper salt, in the presence of potassium chloride. To prepare the salt, dissolve 267 grams of the c. p. ferric chloride of commerce, which contains about fifty per cent. of $FeCl_3$, and 130.7 grams of potassium chloride in a liter of water. Two hundred cc. of this solution will decompose a factor weight of drillings in the same time as the double chloride of copper and potassium. Free hydrochloric acid should not be in excess of the ratio of 1 cc. to 225 cc. The amount of acid should be just sufficient to prevent the formation of any basic salt of iron. By chlorinating the filtrate from the carbon (see *Jour. Am. Chem. Soc.*, 22, 210), it may be used to decompose a second lot of drillings. This may be repeated until sufficient iron has accumulated to permit of the addition of more potassium chloride and a further dilution. The solution after it has decomposed a weight of drillings remains transparent, unlike the copper salt; hence the point when the decomposition of the drillings is complete is readily ascertained. This fact, together with the ease with which one can observe how the filter is holding the carbon, as well as the economy of the process, recommend it. (The article will be published in the *Journal of the American Chemical Society.*)

Condensation of Chloral with the Nitranilins: Alvin Sawyer Wheeler, and H. R. Weller.

Chloral readily reacts with the three nitranilins with the elimination of water, forming condensation products. If the temperature is kept down, addition products are first formed. The condensation products are beautiful crystalline yellow bodies. We name them 'trichlorethyliden-di-nitrophenamines.' The melting points are: o-body, 171°; m-body, 212°; p-body, 218°, uncorr. The para-body was prepared in 1898 independently by Eibner and by Baskerville.

The Electrical Conductivity of Urine and its Relation to Chemical Composition: J. H. Long.

In this paper six complete analyses of normal urines were given along with the electrical conductivity. It was then shown that nearly the same conductivities are obtainable by combining the inorganic salts in the proportions as found by analysis,

the effects of the urea and other organic bodies being but slight. In a lengthy series of tests the variation in conductivity throughout the day is determined. The whole of the day's urine was collected in three-hour periods and in each portion the conductivity was found, and also the amount of chlorine and urea. By calculating the chlorine as sodium chloride and estimating the conductivity of this, by subtraction the element of the conductivity due to other salts is obtained. This becomes a factor of some importance in the study of body metabolism at different periods through the day. The urines of different individuals are compared.

Gluten Feeds, Determination of Fat and Acidity: EDWARD GUDEMAN.

Drying corn gluten feeds in hydrogen, vacuum or air modifies them sufficiently to give low results for the percentage of fat. It increases the acidity of the extracted fat. Gluten meals containing 5.16 per cent. fat before drying gave 3.56 after drying. Acidity of fats extracted before drying, 5–15 per cent., and acidity of fats extracted after drying 20–40 per cent. Acidity of feed materially influenced by the indicators; methyl orange neutral to alkaline, rosolic acid 6–7 acidity and phenolphthalein 11–12 acidity. Acidity of feeds is due to acid salts and is no criterion of quality of feed or of raw materials from which they were made.

A Novel Constant High Temperature Bath: CHARLES BASKERVILLE.

A drawing was shown of the bath, which is essentially an iron water-bath with asbestos jackets wherever exposed and a double cover, one being copper. An iron float, provided with depressions to fit platinum crucibles, which rests upon the fusible alloy, is held in position by copper springs reaching to the copper flange of the bath. A cylindrical handle rises vertically from the center of the float; just above the asbestos cover the iron cylinder is sufficiently large to contain a thermostat by which the gas is controlled. The two covers are provided with slits that they may be placed and removed when the float is in position. A brass sheath containing a thermometer graduated to 550° C. passes through the covers, projecting within one of the crucible depressions. The bath is being used in redetermining the atomic weight of thorium according to the method of C. Krüss, and was paid for in part by a grant from the American Association for the Advancement of Science. (Will appear in the *Journal of the American Chemical Society.*)

Quantitative Blowpipe Analysis by Bead Colorations: JOSEPH W. RICHARDS and WALTER S. LANDIS.

Dr. V. Goldschmidt, of Heidelberg, Germany, has constructed a plate of colored glass, showing the various tints characteristic of the metallic oxides when dissolved in borax bead or salt of phosphorus bead, in the oxidizing or reducing flame. These tables are obtainable from Stoe, Mechaniker, Heidelberg, and therefore are now available as standards for bead colorations. The first part of the work consisted in determining the percentage of metallic oxide present in the beads when presenting the color of the glass representing them on the plate. This we have determined for Fe, U, Cr, V, Mo, Cu, Co, Ni, Mn, Ti and W. These being known, the substance to be tested is weighed off, and enough taken up in a bead to give the standard color. The bead is then weighed, and from the known percentage required to give this color, the amount of coloring oxide is These being known, the substance to be being determined by a second weighing, the percentage of metallic oxide in it is known. The accuracy varies from one to

five per cent. The time necessary is fifteen to twenty minutes. A balance weighing to 0.01 mg. is necessary, if direct weighings are made, but, by a slight modification of the *modus operandi*, satisfactory results may be obtained with a portable balance weighing to 0.1 mg.

Glucose Determination: EDWARD GUDEMAN.

The determination of glucose or grape sugars by use of the polariscope gives incorrect results, due to the variation of the rotating power of these substances being between 80 and 198, instead of the constant 175, generally accepted. Method suggested consists in determining the reducing power on Fehling solution directly, after inversion at 67° C. and after treatment with malt (as for starch analyses). Invert sugar is determined by double polarization at 20° and 87° C. From these results the amount of reducing and non-reducing substances from the glucose or grape sugar is directly calculated, and the sum of the two taken as the actual amount of commercial glucose or grape sugar present in the mixtures.

The Identification, Composition and Analysis of Malt Liquors: CHARLES LATHROP PARSONS.

In three of our northeastern prohibition states the statutes forbid the sale of 'malt liquors.' The task of the chemist is not therefore the usual one of simple alcohol contents, but he is required to prove that the liquor under examination was brewed from malt. The paper gives the analysis of a large number of such liquors and of a few imitations. The identification is mainly accomplished by means of the albuminoids, phosphates, and ash constituents. Analyses show a decidedly poor quality of malt liquor sold in these states and that the percentages of sulfates in the ash are abnormally large, indicating very extensive use of glucose. The chief modifications in the methods of analysis from the official methods were the application of Hind's photometric method for sulfates to the ash and the volumetric determination of phosphates in the ash by uranium acetate, after moistening with concentrated hydrochloric acid and evaporation on the water-bath. (To be published in the *Journal of the American Chemical Society.*)

The Distribution of Hydrogen Sulfid to Laboratory Classes: CHARLES LATHROP PARSONS.

Describes a new generator having the advantages of the perfect automatic action of the Kipp generator, greater regularity of pressure, no second contact with the sulfuric acid, practically complete neutralization of the acid, and its immediate removal from the field of action so that no stoppage from the ferrous sulfate occurs. Coupled with this is used a long lead delivery pipe with exits where desired. These exits are of thermometer tubing specially bent, and of such a length that the student can secure only a limited flow of gas of from one to two bubbles a second. (To be published in the *Journal of the American Chemical Society.*)

The Influence of the Growth of Mold upon the Chemical Composition of Oleomargarine and Butter: C. A. CRAMPTON, Washington, D. C.

Analytical results are given of the values obtained from a series of samples of oleomargarine which had been kept three years and had become infected with a growth of mold. These results showed great variation in composition of the fat, chiefly induced by the mold. The practical lesson is considered, in the way of the interpretation of analytical results, and also the theoretical bearing upon the causes and character of rancidity changes in fats. The paper includes a brief résumé of the more recent articles on this subject, and the author con-

siders that his results bear very strongly in favor of the theory that the rancidity of fats is brought about (primarily, at least) by the influence of the growth of micro-organisms, or the enzymes produced thereby.

On Carbyl Salts: M. GOMBERG.

The paper dealt with results obtained, proving beyond doubt that certain organic halogen compounds must be considered as *salts,* from the chemical as well as the physical point of view, being strong electrolytes. The theory of dissociation can therefore be applied to substances other than those which have been classed as *acids, bases* and *salts.*

Some Preliminary Experiments upon the Clinkering of Portland Cements: E. D. CAMPBELL.

In the first part of the paper the author describes the method used in preparing a number of mixtures of marl and clay or shale. These mixtures were burned in a rotary cement kiln, a description of which appeared in the *Journal of the American Chemical Society,* Vol. 24, No. 3, p. 248. During each burning a series of samples of clinker was collected at temperatures differing by 22° to 30°. Tests of the time of setting and the behavior of the pats, after keeping twenty-four hours in boiling water, were made on each sample of clinker collected. The details of the influence of the temperature of burning on the pats from each series are given in seventeen tables; all the results are summarized in one large table, and compared with those of A. Meyer (*Thonindustrie Zeitung,* Vol. 73, p. 1201). The author has summarized the preliminary work as follows:

Viewed from the standpoint of the influence of chemical composition upon the changes in temperature necessary to produce a sound cement, and the temperature at which the clinker will give trouble by sticking in the rotary, we find to be: The minimum temperature necessary to produce Portland cement which will give a perfect pat test *from fresh clinker* is about 1450° C. This temperature is for minimum amount of CaO. It increases with increase of CaO, until in ordinary commercial cements it reaches 1550°. With the most heavily limed commercial cements this figure would be somewhat higher. It depends somewhat on the length of time required to pass through the rotary, slow driving tending to lower the temperature. The substitution of Al_2O_3 or Fe_2O_3 for SiO_2, that is, the use of a richer clay, lowers the over-burning temperature, but may lower or raise the temperature required for perfect hot test. With mixtures high in CaO, the burning temperature for perfect hot test is lowered by this substitution, but with mixtures high in CaO, the burning temperature required for perfect hot test is raised and may become coincident with the overburning temperature. Any attempt to raise the over-burning temperature by increasing the proportion of lime will fail to give a perfect hot test, even at the overburning temperature. This is a confirmation of what manufacturing experience has shown, that with lean clays heavily limed there is a margin between the proper clinkering temperature and the over-burning temperature, while with rich clays, in order to prevent the clinker from balling up great care must be exercised to maintain the proper clinkering temperature. With the amount of CaO found in ordinary cement the introduction of eight or nine per cent. of magnesium oxide has but little influence on the temperature for perfect hot test or over-burning temperature. So far as the clinker is concerned, magnesium, as has been maintained by Newberry, acts as an inert substance.

A New Glass of Low Solubility: G. E. Barton.

The statement in a recent number of Science to the effect that American glass is inferior to that made in Germany is without doubt true if for 'Germany' we read 'Jena.' The grounds for the claim that at least one glass made in this country heretofore has been equal to anything made on the continent except Jena glass, I submit herewith. I have here also samples of a new glass of my own devising which is the equal of the Jena glass as regards its resistance to water, acids and carbonates, and superior in its resistance to caustic alkali solutions. I believe this glass will render the statement in Science obsolete. Solubility tests of Whitall Tatum Company, Kavalier, Jena, and the new glass were made by determining the loss in weight sustained by pint flasks when boiled for three hours with solutions of the strength shown in the table, under an inverted condenser. Further details of the method, together with a brief explanation of the reasons for choosing such a method in preference to others, will be found in the complete paper which will be published in the *Journal of the American Chemical Society.* The results obtained were as follows, each figure being the average of three results:

LOSS PER FLASK EXPRESSED IN MILLIGRAMS.

	Whitall Tatum Co.	Kavalier.	Jena.	New Glass.
1% Na_2CO_3 sol.....	134.4	126.6	30 6	32.3
Water.....	8.4	20.6	1.1	.7
0.4% HCl sol.....	4 7	16.2	1.3	1.5
1% NaOH sol.....	100.1	78.4	97.1	89 0
Total.....	247.6	241.8	130.1	123.5

The variations between the new glass and the Jena glass are, with the exception of the solubility in one per cent. sodium hydrate solution, within the limits of factory practice. In resisting the last solution, however, the new glass is over eight per cent. better.

A Process for Rendering Phosphoric Acid Available: Charles Baskerville. Abstract published in the issue of Science for August 8.

A Contribution to the Chemistry of some of the Asphalt Rocks found in Texas: Henry Winston Harper.

This paper constitutes Chapter V. of Bulletin No. 8, the University of Texas Mineral Survey ('Coals, Lignites and Asphalt Rocks of Texas'). It contains new analytical data and it is a contribution to the chemistry of the asphalt rocks and some of the asphalt industrial products of Texas. The paper includes an introduction, analytical methods used, nomenclature, the limits of the proportion of petrolene to asphaltene in asphalts intended for paving purposes, constituents that lessen the value of asphalts used for paving purposes, the specimens examined. The experimental part contains tabulated results which show: loss of weight in vacuo over sulphuric acid 24 hours at room temperature (21°–23° C.); loss of weight when heated and maintained at various temperatures four and seven hours; the influence of a temperature of 160° C. upon the constituents of some asphalt rocks; and many other chemical and physical points of interest regarding the Texas asphalts. It also contains an examination of the percentage of petrolene and asphaltene in the total bitumen; the influence of a temperature of 160° C., continued one hour, upon the percentage of total bitumen in the samples used and upon the percentage of petrolene and asphaltene in the total bitumen; percentage of loss of total bitumen and the percentage of petrolene and asphaltene in the samples treated; analyses of the ash of samples; the bitumen of the asphalt rocks of Texas —preliminary investigation; the petrolene complexes obtained from samples 1605, 1606, 1607—treatment of these complexes

with fuming nitric acid; the action of an alcoholic solution of mercuric chloride and acetate of soda on same; the action of sulphuric acid upon petrolenes 1605, 1606, 1607; bromine absorption and hydrobromic acid produced; the asphaltene complexes obtained from samples 1605, 1606, 1607; treatment of same with fuming nitric acid; bromine absorption and hydrobromic acid produced; the chloroform soluble; 'soft gum' and 'hard gum'—industrial products obtained from Uvalde asphalt rock; proximate and ultimate composition of same; synoptic table of the ultimate analyses; table showing bromine absorption, hydrobromic acid liberated, and sulphur and nitrogen in the petrolene and asphaltene complexes obtained from the asphalt rocks of Texas; bromine absorption and sulphur in asphalts, etc.; heavy crude petroleum from Watters Park, Texas; proximate analysis of the residuum of sample 1601; summary of results.

On account of the large amount of analytical data presented a satisfactory abstract of the paper is impracticable.

Occurrence and Importance of Soluble Manganese Salts in Soils: E. E. EWELL.

In the course of a qualitative examination of an acid soil which failed to grow leguminous crops, it was discovered that the soil contained a very considerable percentage of manganese compounds soluble in water. An aqueous extract of the soil has been found to contain about twice as much manganese as calcium. It is believed that this high proportion of manganese in the soluble salts of this soil contributes very largely to its sterility. The occurrence of soluble manganese compounds in soils has received so little attention in the past that an extended investigation of the occurrence of this element in soils has been undertaken by the Bureau of Chemistry of the U. S. Department of Agriculture. The investigation will include a study of the effects of soluble manganese salts on plants, and the agricultural importance of manganese in soils.

Black Rain in North Carolina: CHAS. BASKERVILLE and H. R. WELLER. Abstract published in the issue of SCIENCE for August 8.

A Modification of the Calorimetric Method of Determining the Heat of Chemical Reactions: ALBERT W. SMITH and EDWARD J. HUMEL.

The modification consists in keeping the contents of the calorimeter during the reaction whose change of heat is to be measured, at exactly the room temperature, by the addition of water at the melting point of ice. The method was proposed some years ago by F. A. Waterman for the determination of the specific heat of metals. It was found to be capable of yielding very accurate results in determining the heating value of fuels by the bomb-combustion method, doing away wholly with two troublesome sources of error in this determination, namely, the water equivalent of the apparatus and the loss or gain of heat by the apparatus from radiation. The number of heat units is found from the weight of ice water added and the room temperature, both of which factors are easily and accurately determinable.

A Source of Error in the Chromic Acid Method of Determining Carbon in Iron: ALBERT W. SMITH and BURTON B. NIEDING.

It was found that when the exit gases from the apparatus, used for the determination of carbon in iron, during the oxidation by chromic and sulphuric acids were passed over pentoxide of iodine heated to 150°, the presence of unoxidized carbon in the form of carbon monoxide could always be detected, usually in material quantities,

often sufficiently large to cause serious error in the determination.

The following papers were also read:

'Bessemer and Open-hearth Steel Practice': Edward H. Martin and Wm. Bostwick.

'Manufacture of Optical Glass': Geo. A. MacBeth.

'The Ozone from Potassium Chlorate': Edward Hart. (By title.)

'Malleable Iron': H. E. Diller.

'The Old and the New in Steel Manufacture': Wm. Metcalf.

'The Exactness of Faraday's Law': T. W. Richards.

'Ionic Velocities in Liquid Ammonia Solution': E. C. Franklin.

'Solubility, Electrolytic Conductivity, and Chemical Action in Liquid Hydrocyanic Acid': Louis Kahlenberg and Herman Schlundt. (By title.)

'Molecular Attraction': J. E. Mills. (By title.)

'A New Apparatus for Measuring the Coefficient of Expansion of Gases': T. W. Richards and K. L. Mark.

'Electrolytic Deoxidation of Potassium Chlorate': Wilder D. Bancroft. (By title.)

'The Solid Phases in Certain Alloys': Wilder D. Bancroft. (By title.)

'Otto Hoffman By-product Coke': C. G. Atwater.

'Crucible Steel Manufacture': E. L. French.

'A Proposed Distillation Test for Fireproofed Wood': C. F. McKenna. (By title.)

'Comparison of Results Obtained by Different Methods of Determining the Amount of Oxygen Absorbed by Waters Containing Oxidizable Substances': Leonard P. Kinnicutt. (By title.)

'An Improved Grinder for Analyses of Mother-beets': David L. Davoll, Jr. (By title.)

'Electric Combustion': Edward Hart. (In abstract.)

'The Retention of Arsenic by Iron in the Marsh Test': C. L. Parsons and M. A. Stewart.

'A New Electric Test Retort': Chas F. McKenna. (By title.)

'The Distribution of Hydrogen Sulphide to Laboratory Classes': C. L. Parsons. (By title.)

'The Hydrolysis of Maltose and Dextrine for the Determination of Starch': W. A. Noyes, G. Crawford, C. H. Jumper and E. L. Flory.

'Some Notes on Glass and Glass Making': Robert Linton.

'Plate Glass Manufacture': F. P. Mason. (By title.)

'Symmetrical Trimethylbenzyl, Symmetrical Trimethylbenzol Hydrazone and some of its Derivatives': Everhardt P. Harding.

'1-4-Dimethylbenzyl, 1-4-Dimethylbenzol Hydrazone and some Derivatives': Everhart P. Harding.

'The Action of Valerianic Acid and Valeric Aldehyde upon Antipyrin': David C. Eccles. (By title.)

'A Chemical Study of the Pitch of the Northern Pine': G. B. Frankforter.

'Derivatives of Eugenol': G. B. Frankforter and Max Lando.

'The Reaction of Bromine upon Oxalic Acid': T. W. Richards and W. N. Stull. (By title.)

'Isomeric Oxy-Azocompounds': W. McPherson. (By title.)

'Reaction between Acid and Basic Amides in Solution in Liquid Ammonia': E. C. Franklin and O. F. Stafford.

'Picryl Derivatives of some Phenols': H. W. Hillyer. (By title.)

'Camphoric Acid: Synthesis of Trimethylparaconic Acid': W. A. Noyes and A. M. Patterson.

'Recent Progress in the Fireproofing Treatment of Wood': S. P. Sadtler. (Will be printed in Science.)

'Manufacture of White Lead': G. O. Smith.

'On some Expansion Measurements of Portland Cement': E. D. Campbell. (By title.)

'The Probable Existence of a New Carbide of Iron': E. D. Campbell. (By title.)

'The Discovery of a Dextrose Factor in Saturated Cane Sugar Solutions': L. W. Wilkinson. (By title.)

'The Composition of Myrtle Wax': W. R. Smith and F. B. Wade.

Pittsburgh being at the center of the region of greatest iron and steel production of the United States, opportunities were offered the members to inspect many of the great metallurgical establishments. Visits were made also to the works of the H. J. Heinz Company, manufacturers of food products, to the oil works of the Atlantic Refining Company, to the oil wells of the Forest Oil Company, and to the Demmler works of the American Tin Plate Company. The many courtesies shown by the officers of these works added much to the pleasure and interest of the Pittsburgh meeting.

MEMBERSHIP OF THE ASSOCIATION.

THE following have completed their membership in the American Association for the Advancement of Science during the months of June and July:

Lewis E. Akeley, Univ. of S. Dak., Vermillion, S. Dak.

Delos Arnold, Pasadena, Cal.

Donald S. Ashbrook, 3614 Baring St., Philadelphia, Pa.

B. R. Baumgardt, 626 W. 30th Street, Los Angeles, Cal.

James W. F. Beatty, Pitcairn, Pa.

T. Raymond Beyer, 119 Maplewood Ave., Germantown, Pa.

Ernest Blaker, Pleasanton, Kansas.

Charles H. Bowman, School of Mines, Butte, Montana.

Edwin T. Brewster, Phillips Academy, Andover, Mass.

Luther S. Brock, M.D., Morgantown, W. Va.

D. I. Bushnell, Jr., Peabody Museum, Cambridge, Mass.

Wm. P. Carr, M.D., 1418 L St., N. W., Washington, D. C.

Shelby C. Carson, M.D., Greensboro, Ala.

Charles E. Chambliss, Exper. Sta., Clemson College, S. C.

Wm. W. Churchill, 26 Cortlandt St., New York City.

Friend E. Clark, New Martinsville, West Va.

J. Morgan Clements, Univ. of Wisconsin, Madison, Wis.

Geo. H. Colton, Hiram College, Hiram, Ohio.

Pontus H. Conradson, Franklin, Pa.

Frank H. Constant, University of Minnesota, Minneapolis, Minn.

Hermon C. Cooper, 114 Waverly Ave., Syracuse, N. Y.

Edward Cowles, M.D., Waverley, Mass.

John Cox, McGill Univ., Montreal, Canada.

Alex. R. Craig, M.D., 232 Cherry St., Columbia, Pa.

John B. Crombie, M.D., 500 North Ave. W., Allegheny, Pa.

G. Lenox Curtis, M.D., 7 West 58th St., New York City.

Charles G. Davis, M.D., 31 Washington St., Chicago, Ill.

Frederick S. Dellenbaugh, Century Club, 7 West 43d St., New York City.

Kennon Dunham, M.D., Auburn Ave. and McMillan St., Cincinnati, Ohio.

Nevin M. Fenneman, Madison, Wis.

John C. Fetterman, Castle Shannon, Pa.

Henry W. Fisher, 5403 Friendship Ave., Pittsburgh, Pa.

Margaret P. Forcee, M.D., Arch near Ohio St., Allegheny, Pa.

Chas. W. Foulk, Ohio State Univ., Columbus, Ohio.

E. L. French, Crucible Steel Co., Syracuse, N. Y.

James W. Goldthwait, 93 Nahant St., Lynn, Mass.

Geo. P. Grimsley, Washburn College, Topeka, Kansas.

Benjamin F. Groat, Univ. of Minnesota, Minneapolis, Minn.

Artemus N. Hadley, Box 313, Indianapolis, Ind.

James D. Hailman, Shady Avenue, Pittsburgh, Pa.

Robert W. Harris, M.D., 621 Vincennes St., New Albany, Ind.

C. Willard Hayes, U. S. Geological Survey, Washington, D. C.

Ellery C. Hebbard, M.D., 122 Huntington Ave., Boston, Mass.

John B. Herron, S. Linden Ave., E.E., Pittsburgh, Pa.

Wm. F. Hillebrand, U. S. Geol. Survey, Washington, D. C.

Frederick Homburg, 104 West Clifton Ave., Cincinnati, Ohio.

John D. Hooker, 325 West Adams St., Los Angeles, Cal.

Albert L. Hopkins, 2904 West Avenue, Newport News, Va.

Frederick Houghton, Public School No. 7, Buffalo, N. Y.

J. F. Jenkins, M.D., 48 Chicago St., Tecumseh, Mich.

John B. Johnson, 708 East Colorado St., Pasadena, Cal.

Thos. C. Johnson, 375 Spruce St., Morgantown, West Va.

Myer M. Kann, Station B, Pittsburgh, Pa.

Gustav A. Kletzsch, M.D., 453 Cass St., Milwaukee, Wis.

Israel P. Klingensmith, M.D., Blairsville, Pa.

Edgar L. Larkins, Lowe Observatory, Echo Mountain, Cal.

Ellis W. Lazell, 1619 Filbert St., Philadelphia, Pa.

Edwin Linton, Washington and Jefferson Coll., Washington, Pa.

T. Mortimer Lloyd, M.D., 125 Pierrepont St., Brooklyn, N. Y.

Wm. Lochhead, Ontario Agric. Col., Guelph, Ontario, Canada.

Edgar O. Lovett, Princeton Univ., Princeton, N. J.

D. J. McAdam, Washington, Pa.

Anna J. McKeag, 14 East 16th st., New York City.

J. C. McLennan, Toronto Univ., Toronto, Ontario, Canada.

Fred. W. McNair, Houghton, Mich.

W. L. Miggett, 331 Jefferson St., Ann Arbor, Mich.

J. Pearce Mitchell, 227 Benefit St., Providence, R. I.

Kiichi Miyake, Cornell University, Ithaca, N. Y.

Robert C. Morris, Cheyenne, Wyoming.

Frank C. Newell, 434 Rebecca Ave., Wilkinsburg, Pa.

Lewis G. Nolte, Senns Block, Milwaukee, Wis.

Ezra Palmer, M.D., 2 Lincoln Hall, Trinity Court, Boston, Mass.

A. M. Patterson, Rose Polytechnic Inst., Terre Haute, Ind.

John W. Perkins, M.D., 423 Altman Bldg., Kansas City, Mo.

G. Gilbert Pond, State College, Pa.

Wm. P. Potter, 304 St. Clair St., Pittsburgh, Pa.

LeGrand Powers, 3007 13th St., N. W., Washington, D. C.

A. L. Quaintance, College Park, Md.

Calvin W. Rice, c/o Nernst Lamp Co., Pittsburgh, Pa.

Herbert M. Richards, Barnard Coll., Columbia Univ., New York City.

Henry L. Rietz, Butler College, Gilmore, Ohio.

F. G. Ross, Vandergrift, Pa.

T. M. Rotch, M.D., 197 Commonwealth Ave., Boston, Mass.

John J. Rothermel, 9 Fourth St., S. E., Washington, D. C.

John B. Russell, Wheaton, Ill.

Wm. H. Sands, M.D., Fairmont, West Va.

K. I. Sanes, M.D., 1636 5th Ave., Pittsburgh, Pa.

Henry C. Shaw, Glenshaw, Pa.

Jesse P. Simpson, M.D., Palmer, Ill.

E. R. Smith, M.D., Toledo, Iowa.

Herbert H. Smith, Carnegie Institute, Pittsburgh, Pa.

Francis L. Stewart, Murrysville, Pa.

Arthur N. Talbot, Univ. of Illinois, Champaign, Ill.

Wm. W. Torrence, M.D., 649 Main St., Deadwood, S. Dak.

Frederic E. Turneaure, Univ. of Wisconsin, Madison, Wis.

Charles von Hoffmann, M.D., 1014 Sutter St., San Francisco, Cal.

Charles E. Wait, Univ. of Tenn., Knoxville, Tenn.

Frederic L. Washburn, 1005 University Ave., S. E., Minneapolis, Minn.

Alfred Weed, c/o Nicholson File Co., Providence, R. I.

C. Gilbert Wheeler, 14 State St., Chicago, Ill.

J. C. Williams, 221 Orchard St., Ridgway, Pa.

Arthur L. Williston, Pratt Institute, Brooklyn, N. Y.

Samuel W. Williston, Univ. of Kansas, Lawrence, Kansas.

Paul Wolfel, c/o Am. Bridge Co., Pencoyd, Pa.

A. J. Wood, Delaware Coll., Newark, Del.

Matthew P. Wood, 234 West 44th St., New York City.

Alfred A. Woodhull, M.D., 46 Bayard Lane, Princeton, N. J.

Samuel B. Woodward, M.D., 58 Pearl St., Worcester, Mass.

Cary Wright, Box 654, Boise, Idaho.

S. Edward Young, 2512 Perrysville Ave., Allegheny, Pa.

THE BOTANICAL SOCIETY OF AMERICA.

THE sessions of the Eighth Annual Meeting of the Botanical Society of America were held in Pittsburgh, Pa., June 30, July 1 and 2, 1902.

Officers were elected for the ensuing year as follows:

President, Beverly Thomas Galloway, Bureau of Plant Industry, Washington, D. C.

Vice-President, Frederick Vernon Coville, Bureau of Plant Industry, Washington, D. C.

Treasurer, Arthur Hollick, New York Botanical Garden, New York City.

Secretary, Daniel Trembly MacDougal, New York Botanical Garden, New York City.

Councilors, William Trelease, Missouri Botanical Garden, and Lucien Marcus Underwood, Columbia University.

The above officers with Past President J. C. Arthur constitute the Council of the Society.

Members.—The following associates were elected members:

Benjamin Minge Duggar, Professor of Botany, University of Missouri; Rodney Howard True, Physiologist, Bureau of Plant Industry, Washington, D. C.; Francis Ernest Lloyd, Professor of Biological Science, Teachers' College, Columbia University; George Thomas Moore, Physiologist, Bureau of Plant Industry, Washington, D. C.; Lewis Ralph Jones, Professor of Botany, University of Vermont.

Associates.—The following persons were elected associates:

William L. Bray, Associate Professor of Botany, in charge of School of Botany, University of Texas; Carlton Clarence Curtis, Tutor in Botany, Columbia University; Frank S. Earle, Assistant Curator, New York Botanical Garden; Edward Charles Jeffrey, Assistant Professor of General Morphology, Harvard University; Thomas Macbride, Professor of Botany, State University of Iowa, Professor of Pharmacognosy in the College of Pharmacy U. of I., and Member of Staff of the State Geological Survey; Peter Henry Rolfs, Pathologist, Bureau of Plant Industry, in charge of Tropical Laboratory, Miami, Florida; Augustus D. Selby, Professor of Botany, Wooster, Ohio; Frank Lincoln Stevens, Professor of Biology, College of Agriculture and Mechanic Arts, Raleigh, N. C.

The Society now includes 36 members, 21 associates and 1 patron.

The report of the Treasurer showed a balance of $2,628.24 of cash on hand, the receipts during the year amounting to about $500, in consequence of which the declared policy of the Society relative to research work was put in the form of resolutions by which grants may be made in aid of research (see below).

A committee consisting of Messrs Underwood, Coulter and Galloway, upon the relations of the Botanical Society of America to other botanical organizations, was appointed, Professor Underwood being chairman.

The following papers were presented during the sessions devoted to scientific subjects:

Address by Past President, B. D. HALSTED, 'Two Centuries of American Botany.' (Not delivered, owing to illness of Past President.)

'The Relations of the Botanical Associations of the Country': J. M. COULTER.

'Suggestions for Ecological Cartography': H. C. COWLES.

'Fossil Ferns from the Laramie Group of Florence, Colorado': ARTHUR HOLLICK.

'The Genus *Gymnogramma*, and its Treatment by English Botanists': L. M. UNDERWOOD.

'Studies on Reproduction by Gemmæ of the Prothallus of Ferns': ELIZABETH G. BRITTON.

'Tea Fermentation': R. H. TRUE.

'Some Disorganization Products of Plant Cells': A. F. WOODS.

'Studies in *Cyperus* and Other Cyperaceæ': N. L. BRITTON.

'A Disease of *Catalpa speciosa*': H. VON SCHRENK.

'The Geasters of the United States' (by invitation): MISS V. S. WHITE.

'The Dimensional Relations of Compound Leaves' (by invitation): CHARLES ZELENY.

'Parthenogenesis in Seed Plants': J. M. COULTER.

'The Cytology of the Secreting Epithelium of *Zea Mais*' (by invitation): JOHN C. TORREY.

'North American Species of *Leptochloa*': A. S. HITCHCOCK.

'The Genus *Ganoderma* in North America' (by invitation): W. A. MURRILL.

'A Study of *Astragalus*': P. A. RYDBERG.

'The Stimulus to Heterophylly in *Proserpinaca palustris*' (by invitation): W. B. MCCALLUM.

'The Genus *Sematophyllum* (*Raphidostegium*)': ELIZABETH G. BRITTON.

'Maturation Divisions in the Pollen Cells of Hybrid Cottons' (by invitation): W. A. CANNON.

'The Embryology of the Cucurbitaceæ' (by invitation): J. E. KIRKWOOD.

'Anatomy and Physiology of *Baccharis genistelloides*' (by invitation): MISS E. M. KUPFER.

'Dimorphic Structure of the Phyllodes of *Oxypolis filiformis*' (by invitation): MISS R. J. RENNERT.

'Recent Investigation in the Pleistocene Flora of Maryland' (carried out under the auspices of the Maryland Geological Survey, and presented by permission of the State Geologist) (illustrated): ARTHUR HOLLICK.

'A Comparative Study of the Sand Dunes of the Ocean and Lake Shore' (illustrated): H. C. COWLES.

'The Relations of Light and Darkness to Growth and Development': D. T. MacDougal.

'The North American Species of *Trichomanes*': Elizabeth G. Britton.

'A Green Organism Found in Water Tanks and Reservoirs in Arizona' (by invitation): J. J. Thornber.

'Mitosis of the Primary Nucleus in *Synchytrium decipiens*' (by invitation): F. L. Stevens.

During the first nine years of its existence the Society has steadfastly refused to permit its funds to be drawn upon for any purpose except to meet the actual expenses of administration, it being the avowed purpose of the organization to use its resources in the furtherance of botanical research. The membership of working botanists is thoroughly in sympathy with this idea, and by a formal resolution at the Denver meeting in August, 1901, the Society declared its policy of using its income as soon as the annual receipts amounted to five hundred dollars.

It was found possible to take up this purpose of the Society at the last meeting and the following enabling resolutions were passed, by which the sum of five hundred dollars is to be set aside yearly to be distributed as grants among the members and associates. It is to be noted that the making of the grants in question does not exhaust the annual income of the Society, provision being made for addition to the permanent funds. The exact wording of the resolutions is as follows:

GRANTS IN AID OF INVESTIGATION.

Resolved: That applications for grants in aid of investigations may be made at any time by members or associates in good standing. Such applications should be made to the secretary, accompanied by a detailed statement in regard to the work for which the grant is requested, and shall be referred by the secretary to the Council. The Council shall report upon all applications at the next meeting subsequent to the date at which they are received. The amount of any grant confirmed by the Society may be drawn by the applicant from the treasurer within six months after the meeting at which the grant was made, after a proper receipt has been made therefor.

The recipient of a grant must make a report of the progress, or of the completed results of the investigations for which the grant was given, at the next annual meeting, and at every succeeding meeting until the work in question is finished. Such report must be made in writing to the Council, and may or may not be referred to the Society. Any and every paper dealing with the results of investigations carried out by the aid of grants as above, shall bear the imprint, 'Investigations prosecuted with the aid of a grant from the Botanical Society of America.'

Resolved: That at the next meeting of the Society a grant or grants in aid of investigations may be made in any amount not to exceed the total sum of five hundred dollars ($500) to members and associates of the Society.

D. T. MacDougal,
Secretary.

New York Botanical Garden.

THE INTERNATIONAL AERONAUTICAL CONGRESS.

The third meeting of the International Committee for Scientific Aeronautics, appointed by the meteorologists in 1896, was held at Berlin, May 20–24, and by reason of the number of military and scientific men who were invited to attend, it is more widely known than either of the preceding meetings of the committee at Strassburg in 1898 and at Paris in 1900. The Kaiser, who has done so much to advance aeronautics, both practical and scientific, was expected to attend the opening of the Congress in the great hall of the Reichstag, but, being absent from Berlin, he delegated Prince Frederick Henry of Prussia as his representative and telegraphed his wishes for the success of the deliberations. After an introduction by Professor Hergesell, president of the Committee, the representative of the Minister of Public Instruction recognized the importance of international cooperation in meteorological and magnetic researches, and predicted important results from the present conference.

Dr. von Bezold, director of the Prussian Meteorological Institute, showed how, by the use of balloons and kites, our knowledge of the high atmosphere had been increased through various nations working with a single purpose, and Professor Hergesell explained further the results and objects of international cooperation in scientific aeronatics.

There were present of the International Committee for Scientific Aeronautics, Professor Hergesell, Dr. Assmann and Mr. Berson, representing Germany, General Rykatchef and Colonel Kowanko, of Russia, Messrs. Cailletet and Teisserenc de Bort, of France, and the writer from the United States. At the first meeting of the Committee fifteen new members were chosen, including representatives of the Italian, Spanish and British governments, which had participated in this Congress for the first time. It was decided that the scientific discussions should be open to the invited specialists who numbered about one hundred, while the administrative questions should be considered by the Committee in closed session. One of these questions related to the protection of balloons and apparatus that fall in a foreign country, cameras, in particular, having been regarded with suspicion by the military authorities. Another topic of discussion was the raising of funds from the various countries for the regular publication of the results obtained from the international ascents of balloons and kites. The consideration of some of these data was now begun in the public meeting by General Rykatchef, director of the Central Physical Observatory at St. Petersburg, who described the results of the observations with kites and balloons at Pawlowsk and St. Petersburg during the past five years. By means of kites the details of the conditions prevailing up to 3,000 meters were ascertained, especially the influence of day and night on the vertical changes of temperature. The decrease is greatest during the day and in summer, while during the evening and in winter large inversions of temperature occur. In the lower strata of anticyclones these inversions are marked, while in the upper regions the decrease of temperature is rapid. It was announced that the Tsar had given a considerable sum of money for the prosecution of these experiments. M. Teisserenc de Bort, of Paris, discussed the temperature of the high atmosphere, ten or fifteen kilometers above the earth, as deduced from the ascents of 258 *ballons sondes* at Trappes, and showed, contrary to the general belief that the decrease approached the adiabatic rate at these great heights, that there was a stratum eight to ten kilometers thick, depending on the season and weather conditions, where, not only does the temperature not diminish with augmenting height, but rather tends to increase. Dr. Assmann, director of the Aeronautical Observatory of the Prussian Meteorological Institute, stated that the German observations had led him to the same conclusion regarding this warm upper current.

Professor Palazzo, director of the Italian Meteorological Office, announced that in consequence of a subvention from the Ministers of Agriculture and War the project of his predecessor, M. Tacchini, to establish kite-stations on mountains could be realized. Professor Palazzo said that the observatory on Monte Rosa would be completed next year and that, besides the routine observations, it would be available for physical investigations. Dr. von Schrötter, of Vienna, urged the importance of the study in balloons of the chemical intensity of light, especially of light reflected from clouds.

Dr. Assmann next described his rubber or registration balloon, *ballon sonde*. The usual paper or silk balloon, open at the bot-

tom, has the disadvantage of rising more and more slowly as it approaches its culminating point, and, consequently, the temperatures registered are influenced by insolation to an unknown amount. Closed balloons of expansible material, however, rise with a constantly increasing velocity until they burst, thus insuring sufficient ventilation of the instruments. A parachute moderates their fall, so that they reach the earth without injury. The small size of the rubber balloon and the moderate quantity of hydrogen gas needed is an advantage as regards both cost and ease of manipulation. Such a balloon, holding at the start about one cubic meter of gas, weighs only 380 grams, or, with the instrument, 500 grams. A balloon formed by dipping a mold into a solution of india-rubber, was expanded to 68 times its original volume before it burst, which indicated that it would rise to an altitude of about 38 kilometers. The subject of sensitive thermometers for *ballons sondes* was opened with an account of some tests by Dr. Valentin, of Vienna. M. Teisserenc de Bort exhibited a thermograph in which the Bourdon tube was insulated by a piece of hard rubber and Dr. Hergesell showed another instrument in which a curved metal tube transmitted its changes of length through a bar of nickel steel that had almost no coefficient of expansion. It was proposed that these two thermometers should be tried together in a balloon sent up at night, so that the disturbing effect of insolation might be avoided. A statoscope, to indicate the rise or fall of a manned balloon, the invention of Captain Royas, was exhibited by Major Vivez y Vich, of Madrid, and a project of directing an airship from the ground by means of Hertzian waves was explained by Mr. Alexander, of Bath, England.

Kites and kite-stations were then considered, the writer first presenting his plan to explore the atmosphere over the tropical and equatorial oceans by means of kites flown from a steamship, as outlined in Science, Vol. XIV., pages 412–13 and 896–97. He stated that application had been made to the Carnegie Institution for a grant of $10,000 to defray a portion of the expenses, but still he hoped his German colleagues might cooperate in this large undertaking. The project was enthusiastically received, Dr. von Bezold remarking that the importance of the proposed investigation consisted in the fact that quite a different vertical distribution of temperature might be expected to prevail over the ocean from that found over the land. The conditions of equilibrium are disturbed over the ocean, not by heating the lower layers of air but by cooling the upper strata, and hence at sea and on the coast thunderstorms are most frequent during the cold season and at night, while on land the reverse obtains. More than two years ago he had proposed to explore these regions by an expedition furnished with kites which project was unavoidably postponed, but now, as Mr. Berson stated it might be carried out in cooperation with Mr. Rotch. Professor Köppen, of Hamburg, said that the Scandinavian Hydrographic Congress had arranged four cruises a year in the northern seas and the Deutsche Seewarte would operate meteorological kites on board the vessel. The Göttingen Society of Science has recently sent out a geophysical expedition to Samoa, which was to fly kites with registering instruments, both there and on the return voyage. On the Lake of Constance, also, meteorological kite ascents will be made upon a vessel furnished by Count Zeppelin, through the cooperation of the Meteorological Service of Alsace-Lorraine. A resolution was then passed, recognizing the importance of Mr. Rotch's proposed voyage to increase our knowledge of the distribution of temperature in the

atmosphere, and expressing the hope that, by government aid, the plan might soon be carried out. Professor Köppen submitted a new publication of the Deutsche Seewarte containing the results of his experiments with kites at Hamburg and he announced that, through Franco-Scandinavian cooperation, kite flights were to be made this summer at Viborg in Jutland, simultaneously with flights at Hamburg and Berlin, so that valuable vertical sections of the barometric depressions traversing north Germany would probably be obtained. Professor Hergesell mentioned the fact that kites had been flown upon the Vosges mountains.

General Rykatchef exhibited a new anemometer, invented by Mr. Kusnetzof, and intended to be carried by a kite, which has bridled Robinson cups to record the force of the wind at each instant. Another anemometer, exhibited afterwards by Mr. Gradenwitz, an engineer of Berlin, had a glass cylinder partly filled with glycerine, which is rotated by the Robinson cups and the parabolic surface of the liquid shows on a concentric scale the velocity of the wind. M. Teisserenc de Bort urged the importance of sounding the atmosphere at frequent intervals and showed diagrams of such a series of soundings made with kites and *ballons sondes* almost daily during thirty-six days at his observatory near Paris, to an extreme height of twelve kilometers. The rise and fall of the isotherms during the passage of areas of high and low pressure indicated graphically the complicated conditions which still require further investigation.

The next session was occupied with the topic of high ascents. Professor Cailletet, of Paris, exhibited his apparatus for breathing oxygen at great elevations. The old method of using the compressed gas required a large and heavy receptacle, but liquid gas can be much more conveniently carried and after it is allowed to evaporate and to mix with air, by means of a specially constructed mask the aeronaut is forced always to breathe the mixture. Dr. Süring, of Berlin, described the physiological phenomena attending his record-breaking ascent with Mr. Berson to the height of 10,800 meters on July 31, 1901, and Dr. von Schrötter stated that his own experiments in a pneumatic cabinet, under a pressure of 230 millimeters of mercury, proved that the respiration of oxygen restored both the physical and mental power. He also exhibited a breathing mask which was to be tried with the one of M. Cailletet during the next balloon ascent. Count Zeppelin called attention to the well-known fact that birds often soar above high mountains as proving that they avail themselves of the rising currents of air, and suggested that ascents of *ballons sondes* in such places might give interesting results. Lieutenant von Lucanus, on the part of the German Ornithological Society, advocated observations in balloons to determine the various levels at which birds are found. At the close of the session a telegram was sent to James Glaisher, the Nestor of scientific aeronauts, in London, with the greetings of his colleagues assembled from Europe, Asia and America.

The last session of the Congress was devoted to a discussion of measurements of atmospheric electricity and terrestrial magnetism in balloons. Assuming that the electrification of the air occurs through 'ions' or 'electrons,' as shown by the dispersion apparatus of Elster and Geitel, it is of great interest to determine how the constitution of the air, as regards positive and negative ions, varies with height. By using an aspirator to bring a definite quantity of air over the apparatus, Professor Ebert, of Munich, said that he had obtained absolute measurements of the quantity of free electricity in a cubic meter of air. In

the discussion, Dr. von Bezold remarked that the connection between the Föhn wind and the number of ions in the air was now being studied. The air brought down from a great height by the Föhn carries more ions to a lower level and there thus appeared to be a relation between mountain sickness and the well-known physiological effects of the Föhn. Professor Palazzo, of Rome, explained his photographic arrangement of Exner's electrometer, for use in balloons, and Dr. Linke, of Potsdam, described the measurements he had made in balloons to determine the change of potential and conductivity of the air. He had confirmed his early results that the potential was always positive, but found the variation of the conductivity in cloud strata depended upon the weather conditions. The vertical motion of the balloon introduced complications which made the dispersion observations very difficult. On the request of Professor Ebert, the Congress recognized the importance of executing electrical measurements in balloons. The same speaker showed an apparatus for determining the horizontal magnetic intensity in a balloon without knowing either the astronomical or magnetic meridian. This is not only of scientific importance, but may be practically useful to guide the aeronaut at night and when he is in the clouds or over the sea. Dr. Marcuse, of Berlin, then showed an instrument for determining astronomically in a balloon its position. Dr. Kassner, of Berlin, suggested that kites and kite-balloons might be employed in the following scientific investigations: in physics for the determination of the conditions affecting the velocity of sound, in geodesy and astronomy for researches as to the causes of the variation in atmospheric refraction and in meteorology for a study of the action of 'hail shooting.' Finally Director Archenhold, of the Treptow Observatory in Berlin, said that the volcanic eruptions in the West Indies may produce optical phenomena similar to those following the Krakatoa explosion, namely, first brilliant sunsets and then the luminous night clouds which would be first perceived by aeronauts during nocturnal ascensions.

The Committee recommended that the international ascents of balloons and kites should take place, as heretofore, on the first Thursday of each month, and the *ballons sondes* should be liberated an hour before sunrise in order that the instruments may be unaffected by insolation and the balloons may be seen when they fall to the earth. The employment of the insulated thermometer and of the sensitive metallic thermometer already described were likewise advised. The president noted with satisfaction the arrangements by which kite flights would be made above the seas, lakes and mountains, and hoped that the British Government would aid in the investigation of the great Asiatic monsoon region. The Congress was then closed, but the Committee in executive session formulated resolutions, among them a request to the Reichschancellor for a subvention to defray half the cost of the proposed German-American kite expedition to the tropics.

The entertainments were a notable feature of the Congress. During a visit to the Aeronautical Observatory of the Prussian Meteorological Institute, at West Reinickendorf, a few miles north of Berlin, the kites, kite-balloon and rubber *ballons sondes* were sent up, one of the last attaining the unprecedentedly great height of twenty kilometers. The following day, after the adjacent establishment of the Prussian Balloon Battalion, which is the most modern and complete in the world had been inspected, field manœuvres were executed and the time required to bring the kite-balloon on the field, inflate it and send up an officer to reconnoiter was found to occupy but sixteen minutes. A number

of free balloons ascended from the grounds carrying military and civil members of the Congress, one of the latter ascents being for meteorological purposes and another for physiological experiments. A sumptuous breakfast, given by the officers of the Balloon Battalion in their Casino, was attended by the Minister of War, and at a banquet given in the Zoological Garden in honor of the Congress, Prince Frederick Henry presided. It is evident, therefore, that the organizers of the Congress succeeded in pleasing their guests and in giving the foreign military officers, who represented the chief European powers excepting France, an idea of the high efficiency of military ballooning in Germany. As regards the exploration of the atmosphere, nowhere is there a station so completely equipped as the one directed by Dr. Assmann, and yet, notwithstanding the time and money expended to bring it to this condition, the site near a great city having proved unfavorable for kite-flying, the observatory will be moved into the open country about a hundred miles northeast of Berlin. The observatory of M. Teisserenc de Bort has likewise been removed from the neighborhood of Paris for similar reasons, and this action by both a government and a private institution shows that in Europe 'the sounding of the ocean of air' is regarded as being of sufficient importance to justify its prosecution under the best possible circumstances.

A. LAWRENCE ROTCH.
BLUE HILL METEOROLOGICAL OBSERVATORY.

SCIENTIFIC BOOKS.

The Varieties of Religious Experience: A Study in Human Nature. Being the Gifford Lectures on Natural Religion delivered at Edinburgh in 1901–1902 by WILLIAM JAMES, LL.D., etc., Corresponding Member of the Institute of France and of the Royal Prussian Academy of Sciences, Professor of Philosophy at Harvard University. New York, London and Bombay, Longmans, Green and Co. 1902.

In the portion of this book which is wholly novel in academic philosophy, that which gives a careful statement and a deliberate discussion of 'the religion of healthy-mindedness' (including 'mind-care,' 'Christian science,' etc.) the reader has a fair gauge of the author's spirit and method throughout. We have the 'human documents,' the religious feelings and ideas as set forth in extracts chosen with the happiest discrimination, the analyses and explanations of psychology, and the author's hospitable-minded but critical summing-up. We meet with that reluctance to deny, that wistful sense of 'more beyond,' which is so singularly blended in his writing with sceptical science. We have that vivid perception of the concrete in all its variety, that distrustful interest in abstract theory in all its variety, which make us feel somewhat tossed about on the waves of suggestion, and yet distinctly safer than in the hands of the artificer of consistent systems. And lastly we have the care for results, for the difference a theory makes to life, joined with an individualism, a willingness to live and let live in matters of belief, which would encourage diverse theories to bring forth practical fruit after their kind and so put themselves to the proof. We understand how it could happen that Professor James has been falsely set down as a spiritist, merely because of his completer suspension of judgment in subjects where to hesitate is deemed hardly consistent with scientific propriety. On this point he has elsewhere made his views explicit.* In these peculiarly frank pages there is no trace of any taste for the conception of spirit-possession; it figures, indeed, not at all; but there is repeated refusal to assume that human consciousness is subject to no impressions but those of sense.

Highly characteristic of their author, these lectures stand in marked contrast with the other philosophic courses of the Gifford series. Such lecturers as Professors Caird, Ward and Royce offered abstract reasoning in proof of a

* See review of Hodgson, 'Further Report on Certain Phenomena of Trance,' *Psychological Review.* 1898.

philosophic theism or in confutation of its adversaries. Mr. James writes: 'In all sad sincerity I think we must conclude that the attempt to demonstrate by purely intellectual processes the truth of direct religious experience is absolutely hopeless.' He throws himself instead upon that experience itself, describing its vital richness and variety and analyzing its nature with his well-known gifts of psychologic insight and of style. The aim is to keep as close as possible to the recorded facts of personal religious feeling, especially in its most acute and unprompted phases, since there only do we study the power of religion at its source. To this end ecclesiastical and other social forms are left on one side. To this end too the pages teem with extracts from autobiography, Catholic, Protestant, and non-Christian, illustrative of varied forms of spiritual life. The learning is immense, and the profusion of vital and memorable passages cited makes the volume a treasury in this kind. The author stands by as interpreter, comparer and analyst, and the extracts are woven into a somewhat carefully planned progression of chapters. But he comes not only as a psychologist to describe and classify, but as a philosopher to judge. Indeed the psychologist could hardly seize the nature of the religious sentiment without some estimate of its service and meaning in human nature. But here too his appeal is solely to experience. 'The religion of healthy-mindedness,' the religion of conflict and remorse, conversion, the asceticism of the saintly life, mysticism, dogmatic theology, ritual, confession and prayer are judged by their fruits alone. Thirty years ago Matthew Arnold laid it down that the basis of religion must be sought in the verifiable facts of present human nature and life. Mr. James's attitude is (with one considerable reservation) similar, but it results in a less dry and moralistic conception of that basis. Arnold (though not trained himself in the scientific school) wrote in days of belligerent science and saved but little from the siege. The present work, coming as it does from a master of contemporary psychology, marks a point where science has found its way into too many recesses of human nature to remain in a militant mood toward any of the great propensities whose roots it finds there. Arnold almost confined himself to the moral element in religion, but we have here an interpretation of what must be more broadly called the spiritual.

To some critics, no doubt, the book will hardly seem to invite with any emphasis the term scientific; nor even the term philosophical. Not to dwell upon the unconventional play of wit and imagination in the style, an author who makes so little effort to maintain a systematic rigor of treatment, and who deliberately classes himself as a 'piecemeal supernaturalist,' has chosen, it might seem, to quit the ways of contemporary research. And his supernaturalism might make even a limited comparison with Arnold seem inept. But indeed both what there is of supernaturalism in the book (and when one tracks it resolutely through the various qualifications it proves a somewhat modest quantity) and the indifference to systematic forms, which is indeed carried to a fault, are connected with the author's conscience and candor as a seeker after fact. He has an evident dread of summary divisions and pert generalizations that 'substitute a rude simplicity for the complexity of nature,' and whilst handling and examining such as have been propounded he refuses to be restricted by them. Rejecting the *a priori* methods of some of his predecessors in the Gifford chair, he has more than a usual share of the restless spirit of induction, and will not close the gates whilst but ninety-and-nine of the facts lie safely in the fold. It is the same demand for reality and impatience of formulas thinner than the fact that drives him into what he quaintly calls his 'crass supernaturalism.' "Religion, wherever it is an active thing, involves a belief in ideal presences [*i. e.*, exalted but real presences] and a belief that in our prayerful communion with them work is done and something real comes to pass." It is the fear of 'explaining away,' the distaste for 'mere' and 'nothing but,' the sheer fidelity to the spiritual consciousness of which he is interpreter, that forces him, as he conceives, to regard a reference to the supernatural as essential to com-

plete religion, and such a religion as essential to complete life. Justified or not, his conclusion is due to a sympathy which, necessary for insight as it is, belongs to the very spirit of science when it takes the form of psychology and advances into human nature. One may wish in some particulars to amend the conclusion, but one must own one's debt for an incomparable rendering of the facts.

In undertaking his 'descriptive survey' the lecturer warns his hearers to distinguish between assertions of psychological or physical fact and assertions of spiritual value. The value of a man's religious propensities cannot be judged by the circumstances of their origin. The opening chapter, on 'Religion and Neurology'—announced as a lecture at Edinburgh under the vivacious title 'Is Religion a Nervous Disease?'—deals with the 'medical materialism' which would explain away the intenser spiritual experiences as due to bodily disturbance. "Medical materialism finishes up Saint Paul by calling his vision on the road to Damascus a discharging lesion of the occipital cortex, he being an epileptic. It snuffs out Saint Teresa as an hysteric, Saint Francis of Assisi as an hereditary degenerate. George Fox's discontent with the shams of his age, and his pining for spiritual veracity, it treats as a symptom of a disordered colon. Carlyle's organ-tones of misery it accounts for by a gastro-duodenal catarrh." To which Mr. James answers that by the first principle of physiological psychology "there is not a single one of our states of mind, high or low, healthy or morbid, that has not some organic process as its condition. * * * If we only knew the facts intimately enough we should doubtless see 'the liver' determining the dicta of the sturdy atheist as decisively as it does that of the Methodist under conviction anxious about his soul. When it alters in one way the blood that percolates it we get the Methodist, when in another way the atheist form of mind." Since all thoughts have physical conditions, no thought is by that mere fact discredited. Nor is the distinction between healthy and unhealthy physical conditions decisive in the matter. A temperament nervously unbalanced, however inferior from the standpoint of personal comfort and longevity, is compatible with high social usefulness, may even, in certain forms of such usefulness, be a powerful aid. We must judge the spiritual value of mental states by experience of their results for life. This is something upon which their bodily antecedents shed no light. "When we speak disparagingly of 'feverish fancies,' surely the fever-process as such is not the ground of our disesteem—for aught we know to the contrary, 103° or 104° Fahrenheit might be a much more favorable temperature for truths to germinate and sprout in than the more ordinary blood-heat of 97 or 98 degrees. It is either the disagreeableness itself of the fancies, or their inability to bear the criticisms of the convalescent hour." "By their fruits ye shall know them, not by their roots."

As a purely negative argument, the repulse of an attack, this is admirably conclusive. But when the positive principle is laid down, when consequences are presented as the sole test of religion, there is something else to be said. Origin cannot disprove value, but then consequences cannot prove truth. If religion undertakes to tell of the supernatural, we may know it by its fruits as valuable, but not as true. This, however, seems upon the whole to be the author's view. When in the final chapter it becomes a question, not of human value, but of objective truth, his standards are of another order. In that chapter, however, he first recognizes as tenable the position that religion is a purely human and natural phenomenon, existing for its psychological function; its supernaturalism being but a symbolic expression of natural fact. In that case of course religion grown clear-sighted would assert as literal truth nothing for which universal experience did not vouch; the test of value and the test of truth would coincide. His own analysis is quite consistent with this position. "There is a certain uniform deliverance in which all religions appear to meet." This deliverance tells of "(1) an uneasiness, and (2) its solution. The uneasiness, reduced to its simplest terms, is the sense that there is *something wrong about us* as we naturally stand. The solution is a sense that we are

saved from the wrongness by making the proper connection with the higher powers. * * * Along with the wrong part there is a better part of him, even though it be a most helpless germ. * * * When stage two (the stage of solution or salvation) arrives, the man identifies his real being with the germinal higher part of himself; and does so in the following way. He becomes conscious that this higher part is * * * continuous with a MORE of the same quality, which is operative in the universe outside of him, and which he can keep in working touch with, and in a fashion get on board of and save himself." This *more,* Mr. James is disposed to think, is first of all the subconscious mind or 'subliminal consciousness' whose discovery in 1886 was 'the most important step forward that has occurred in psychology' since he became a student of the science. In conversion, mystical experiences, 'mind-cure' and the effects of prayer, he offers abundant reason for thinking that influences from this region play a leading part. "It is one of the peculiarities of invasions from the subconscious region to take on objective appearances and to suggest to the subject an external control. In the religious life the control is felt as 'higher'; but since on our hypothesis it is primarily the faculties of our own hidden mind which are controlling, the sense of union with the power beyond us is a sense of something, not merely apparently, but literally true."

How completely this accords with Arnold's conception of the name God as a symbolic expression for the purely natural stream of tendency, not our narrower selves, that makes for righteousness, will be seen at once. Beyond this, our author holds, articulate proof cannot go. But let us not, therefore, he would add, make haste to close the door against what may lie beyond. Here begin his 'supernaturalism' and the grounds he recognizes for faith in its 'objective truth.' From two points of view it is legitimate to cross the line. First, the luminous perceptions of the mystical state, supposing them to be as they are reported, are by the logic of the case all-sufficient for the perceiver, but unfortunately non-transferable. Secondly, those who do not share the mystical experience may 'in the exercise of [their] individual freedom' embrace 'over-beliefs' and 'build out their religion' in the direction to which their inward need and 'the total expression of human experience as [they] view it objectively' seem to point. This is of course the thesis of his well-known essays on 'The Will to Believe.' The last phrase quoted shows him still holding to 'experience.' It is not to mere desire or will that he consigns the decision—so one is led, despite some of his own words, to infer; but to the inmost judgment, dealing with probabilities and tokens too delicate for speech. Thus we have in the second basis of belief a fainter sort of perception, which, like the first, must be incommunicable. According to Mr. James's own profession of faith, 'in communion with the Ideal new force comes into the world, and new departures are made here below.' The supernatural force probably enters 'through the subliminal door,' *i. e.,* affecting the subconscious life first, and through it the conscious life. "The current of thought in academic circles runs against me, and I feel like a man who must set his back against an open door if he does not wish to see it closed and locked." That is, though there is nothing, as he has shown, in the psychology of religion that does not seem explicable by natural causes, yet such is our author's jealous fidelity to the religious consciousness and the forms its experiences take that he will not accept an explanation that seems to him to impoverish their meaning. One might suggest that these forms, as a symbolic expression of the deepest facts in human life, are no greater than the things symbolized; and that, needful though it be to preach to science an open imagination, yet it is no service to the general world to identify religion with what is from the general standpoint a mere possibility, not a sure and common possession.

I have been obliged to neglect some of the chief thoughts of the book, such as the psychological distinction between 'moralism' and religion (which recalls the writings of the author's father, the elder Henry James), that between the 'once-born' and 'twice-born' types of religious spirit, the comparison between the principle of modern 'mental heal-

ing' and that of Luther's 'justification by faith,' the profound interpretation of asceticism, etc. Of the work as a whole one may say that it is precisely its 'unsatisfactoriness,' the pregnancy of its paradox in leaving so many doors open and yet keeping so much science within, by which it serves us best. Coming when psychology has just reached the study of religion, it can hardly fail to deepen the whole of the research to which it brilliantly contributes. DICKINSON S. MILLER.

Fishes and Fisheries of the Irish Sea: W. A. HERDMAN and ROBERT A. DAWSON, London, George Philip & Son. 1902. 4to. Pp. 98.

This is the second memoir of the Lancashire Sea-Fisheries Committee, of which Professor Herdman is the honorary director of the scientific work and Mr. Dawson the fishery expert. It is the outgrowth of studies of fishes of the Irish Sea commenced many years ago by Herdman, in connection with the work of the Liverpool Marine Biology Committee. The systematic consideration of the fishes constitutes the major part of this report, but much collateral information adds to its value. In dedicating it to the members of the Lancashire and Western sea-fisheries joint committee, the authors express the hope that the work may fill a want as a guide to the fish and fisheries of the region, and that it may be of value to fishermen and others at home and to fishery authorities and scientific men abroad.

The physical features of the Irish Sea are briefly described under the head of area, depth, rivers and estuaries, temperature, specific gravity, tides and currents, and bottom deposits. This sea, which has an area of about 17,250 square miles, may be regarded as a landlocked body, for the connections with the North Sea (St. George Channel and North Channel) constitute only one tenth of the circumference. In this respect the Irish Sea is said to be unique, for no other sea of equal extent is so completely closed in by land belonging to one nation. "Consequently the Irish Sea seems peculiarly well fitted for those experiments in fisheries administration and cultivation which depend upon identical fisheries regulations."

In connection with the study of the sudden appearance and disappearance of swarms of copepods and medusæ, and the influence of the movements of such and other surface food materials on the migration of fishes, two thousand drift bottles were dropped into the sea at various places, and their behavior forms the basis of the chapter on tides and currents. The recovery of over forty-two per cent. of the bottles furnished data as to the combined effects of tides, currents, and prevailing winds on the distribution of small surface organisms. Considerable influence seems to be exerted by winds on the movements of fish ova, fish larvæ, the fish food, and hence on the abundance of particular species in a given region. The two tidal streams which pour into this sea meet and neutralize each other, causing a zone of water, which extends from one shore to the other and in places is twenty miles wide, where no tidal currents exist, but only a rise and fall; twelve per cent. of the drift bottles were caried by winds from one tidal system to the other.

The nature of the bottom deposits is regarded as the most important of the various factors determining the distribution of animals over the sea-bottom, and this subject, therefore, receives special consideration; and, in connection with the chapter on the distribution of fishes, etc., constitutes the most interesting and important section of the memoir. Sample lists of all species of animals taken in dredge-hauls in different parts of the sea show how the physical conditions influence the abundance of animals as regards individuals and species and make it 'clear that whether it be a question of mere *mass* of life or *variety* of life, haul for haul, the shallow waters can hold their own against the deep sea, and form in all probability the most prolific zone of life on this globe.' This zone in the Irish Sea affords two very distinct types of abundance: the Welsh and Manx coasts are characterized by rocks and sea weeds, the Lancashire and Cheshire coasts by sand and mud; the shore waters of the former abound in species, those of the latter in individuals.

The fishes of the Irish Sea, of which a freely annotated list is given, comprise 141

species; 15 of these are regarded as accidental or occasional stragglers from the ocean, 85 are small inedible species, and 41 are marketable forms. Of the last named, the most numerous and commercially important family are the Pleuronectidæ, 18 species being recorded and noted in detail.

The constitution and work of the sea-fisheries committees are referred to at length. These committees are analogous to the State fish commissions of the United States, but their organization and methods are very different. They are all subordinate to the national Board of Trade, but are vested with large powers in matters of legislation, regulation and investigation; and their work has a number of features that our local fish commissions could consider to advantage. The entire absence of artificial propagation of fishes and other animals is in strong contrast with other countries. Two appendices contain a full draft of the by-laws proposed for the Lancashire and Western sea-fisheries district, and a detailed statement of the results of experimental dredge-hauls, fishing trials, etc. The gathering of shrimps, one of the leading fishery industries of the Irish Sea, is shown to have a remarkable influence on the abundance of fishes and is one of the subjects in dealing with which the services of the biologist have proved most useful. From numerous test trials, it has been demonstrated that shrimping on certain grounds at certain times is enormously destructive to immature fish, as many as 10,000 undersized fish sometimes being killed in taking one quart of shrimp, and the average destruction per quart is said to be 1,000 fish, chiefly pleuronectids.

This memoir constitutes an admirable model for future investigations and reports of its kind. As an example of the harmonious combination of the scientific and the economic, the work will be welcomed by all persons interested in the preservation of one of the most valuable resources of the world. The most useful purpose the work ought to subserve, however, aside from its local application, is the demonstration (1) of the many diverse considerations underlying the regulation and administration of the fisheries, (2) of the necessity for scientific methods in the proper study of economic problems, and (3) of the futility of radical legislation affecting the fisheries without competent biologic investigation. Many fishery laws which have suppressed or seriously disturbed established industries would never have been enacted had the facts been known; and, on the other hand, some languishing fisheries would be improved and failing resources replenished if legislators would heed the results of scientific investigation.

H. M. Smith.

Studies from the Chemical Laboratory of the Sheffield Scientific School. Edited by Horace L. Wells. Vol. I., pp. xi+444; Vol. II., pp. ix+379. New York, Charles Scribner's Sons. 1901.

These volumes appear among the Yale Bicentennial Publications, issued 'as a partial indication of the character of the studies in which the university teachers are engaged.' They furnish a continuous record of recent progressive studies bearing directly upon questions of prime importance at the present time. Certainly they constitute a body of contributions to knowledge highly honorable to the university they represent.

Volume I. opens with a very brief historical account of the Sheffield Laboratory from the beginning, then presents a bibliography of the research publications of the present instructors of the laboratory, and gives in 427 pages the papers of the last ten years on 'General Inorganic Chemistry' and on 'Double Halogen Salts.' Volume II. gives in 371 pages the papers of ten years upon 'Organic Chemistry.'

Well known to chemical readers as these papers have been, there is now much advantage in having them all together in the order in which the investigations have developed. The chemists of the Sheffield Laboratory are to be congratulated upon the prevailing unity and continuity of their labors, extending through so eventful a decade.

The twenty-seven papers upon 'Double Halogen Salts' appeared from 1892 to 1901. Of all the known double halides classified by Professor Wells it is stated that about one third have been prepared in the Sheffield Labo-

ratory. In the determination of the constants of these compounds a great deal of foundation has been laid. So far, it may be said, the facts serve quite as much to do away with false generalizations as to support true ones. Perhaps the results reach toward that borderland of residual affinity which Werner and others have been cultivating. At any rate, whatever is gained in real knowledge of halogen combination touches chemistry everywhere, on inorganic, organic and physical lines, either in elucidation or in restriction of our theories of atomic union and our views of the periodic system.

There are several papers upon perhalides of the metals in the division of 'General Inorganic Chemistry,' and several upon organic perhalides in the 'Organic Chemistry' volume. In the same relation may be included the researches upon double salts and metallic salts of the anilides, and those upon the substitution of one halogen for another in the anilides.

The article on the 'Periodic System and Inorganic Compounds' gives a much needed discussion of the thesis that 'the nature of the *compounds* of an element is also a function of its atomic weight,' and then goes on to report the results of very faithful experimentation upon the alums, in respect to solubilities and other features. It is to be hoped that Dr. Locke will continue his researches in this field, important as it is, and calling for a special allowance of the scientific spirit, evident in his work.

The papers in the volume on 'Organic Chemistry,' familiar as they are to chemical readers, now present a quite logical series of cognate investigations, largely upon the anilides and related imido compounds. Very few of the papers deal with compounds destitute of nitrogen. It is not too much to say that the chemical literature of the bodies just mentioned, as well as that of many formyl compounds, and a good number of imido esters, has been of late years materially enriched by these contributions. The same may be said of the literature of the esters related to carbamic acid and urea. And further experimentations upon ester derivatives of urea are appearing under the name of Professor Wheeler in the journals current since these volumes were issued.

The recent records of the chemistry of Yale are of the greater educational interest because of the early development of the science in the same institution. The account given in Volume I. of the establishment of the Sheffield Laboratory is a good bit of history rescued from the recollections of a very early chemical period. It appears that, as a university laboratory distinctly for students, it was established in 'the old President's house' from 1847 to 1860. The data are well worth saving, for the history of the laboratory method, and to help out what may be gathered from the biography of the elder Silliman, and the sketches of American chemists collected by the younger Silliman in 1876. ALBERT B. PRESCOTT.

The Foundations of Geometry. By DAVID HILBERT. Authorized translation by E. J. TOWNSEND, Ph.D., University of Illinois. Chicago, The Open Court Publishing Company. 1902. Pp. vii+132.

The merest justice calls for a pointing out of some few among the blemishes in what Professor Townsend puts forth as a translation of Hilbert's beautiful 'Festschrift.' These blemishes are the more indefensible because Professor Townsend had before him, in addition to the limpid original, the admirable French translation of L. Laugel.

To begin with, Hilbert, so studiously sparing of words, uses the word Erklärung nine times on his first thirteen pages.

Townsend never renders it at all. Thus Hilbert's profound and elegant distribution into definitions, conventions, assumptions and theorems is totally lost, not appearing in Townsend's translation.

In the third sentence of the introduction Aufstellung is translated choice, and in the fifth sentence aufzustellen is given as 'to choose.' In the note to the introduction, 'instructive account' is rendered 'explanatory report'!

In § 1, p. 3, the point is missed when erfolgt durch is rendered 'follows as a consequence of.'

On p. 5, in note to axioms of order (better axioms of arrangement), W. Pasch should be M. Pasch. On p. 6, first line, die Anordnung, the arrangement, is rendered 'an order of sequence.'

In II., 4, the repetition of the word *'so'* destroys the statement intended.

Could there be a more pitiful bungle than that which, in the last two lines of p. 6, gives 'alle übrigen Punkte der Geraden *a* heissen *ausserhalb* der Strecke AB gelegen' as 'all other points are referred to the *points lying without the segment AB.*'

The translation of the important Axiom IV., 1, p. 12, is so bungled as to be worse than meaningless, actually false, as will be seen by comparing with the French translation:

Si l'on désigne par A, B deux points d'une droite *a*, et par A′ un point de cette même droite ou bien d'une autre droite *a′*, l'on pourra toujours, sur la droite *a′*, d'un côté donné du point A′, trouver un point et un seul B′, tel que le segment AB soit congruent au segment A′B′.

On p. 13, 'emanating' is unfortunate.

On p. 15, l. 10, the angle-symbol is omitted.

On p. 17, l. 8 from below, 'so' should be 'such.'

On p. 22, theorem 16 is mistranslated, the insertion of the word 'corresponding' turning it into bathos.

But on p. 24 we have a still more ludicrous misinterpretation, which shows that Professor Townsend has not attempted to understand the book he attempts to translate. Under the heading Definitions (which should be Definition) he says: 'From this definition can be easily deduced, with the help of the axioms of groups III. and IV., all of the known properties of the circle.'

What a stupendous blunder this is we realize when we recall that thus cannot even be proved that a straight line which has a point within a circle has a point on the circle.

What Hilbert himself proves and what Townsend translates on p. 116, demonstrates that, using axioms I.–IV., we could not even show that from any point without a circle there is a tangent to the circle. Just so, without an axiom of continuity we cannot demonstrate that a circle having a point within and a point without a second circle has a point on it.

On the same p. 24 the introduction, in l. 6 from below, of the word 'corresponding' is a childish mistranslation.

On p. 25 Professor Townsend puts in a little from Laugel, but seems to have no better luck with his French than with the German. 'This axiom gives us nothing directly concerning the existence of limiting points, or *of* the idea of convergence' is how he renders, 'Cet axiome ne nous dit rien sur l'existence de points limites ni sur la notion de convergence.'

But the game would not be worth the candle to go on thus through all the 132 pages.

So I choose as a fitting climax the sentence on p. 125, 'We easily see that the criterion of theorem 44 is fulfilled, and, consequently, it follows that *every regular polygon can be constructed by the drawing of straight lines and the laying off of segments.*'

From this we should suppose that Professor Townsend studied his geometry from the popular treatise of Mr. Wentworth between 1877 and 1887, which during those years contained on p. 224, Proposition XIII., § 387: 'To inscribe a regular polygon of any number of sides in a given circle.'

George Bruce Halsted.

Austin, Texas.

SCIENTIFIC JOURNALS AND ARTICLES.

The Journal of Physical Chemistry. March. 'On the Relative Velocities of the Ions in Solutions of Silver Nitrate in Pyridin and Acetonitril,' by Herman Schlundt. The ionic velocities found are considerably lower than in water, but this difference seems to decrease with increasing dilution. 'On the Inversion of Zinc Sulfate, II.,' by H. T. Barnes and H. L. Cooke. 'Synthetic Analysis of Solid Phases,' by Wilder D. Bancroft. Description of a new method, applicable to alloys, efflorescent substances, basic salts, and double salts which are decomposed by the pure solvent, where the solid phase cannot be conveniently isolated in a pure state. 'A Derivation of the

Phase Rule,' by J. E. Trevor. 'Limitations of the Mass Law,' by Wilder D. Bancroft.

April. 'Molecular Attraction,' by J. E. Mills. The presentation of evidence to prove that molecular attraction, like gravitation, varies inversely as the square of the distance apart of the molecules, that it is only slightly affected by changes in temperature, and that it depends primarily upon the chemical constitution of the molecule and not upon its mass. 'Studies in Vapor Composition, II.,' by H. R. Carveth. 'On the Stability of the Equilibrium of Univariant Systems,' by Paul Saurel. 'On the Fundamental Equations of the Multiple Point,' by Paul Saurel.

SOCIETIES AND ACADEMIES.

THE AMERICAN ANTHROPOLOGICAL ASSOCIATION.

As announced in SCIENCE for June 27, and as briefly noted in the report of the Secretary of Section H of the American Association for the Advancement of Science (this volume, p. 201), an American Anthropological Association was formally established on June 30. The founding meeting was held in Oakland Church, Pittsburgh, under the Chairmanship of Stewart Culin, Vice-president of Section H of the American Association for the Advancement of Science. After the adoption of a constitution the following executive officers were elected:

President, W J McGee; *Vice-President* for four years, F. W. Putnam; *Vice-President* for three years, Franz Boas; *Vice-President* for two years, W. H. Holmes; *Vice-President* for one year, J. W. Powell; *Secretary*, George A. Dorsey; *Treasurer*, Roland B. Dixon; *Editor*, F. W. Hodge.

The plan of the organization providing for a Council large enough to include the leading workers in American anthropology, the following persons, all of whom except two (who chanced to be abroad) had indorsed the objects of the Association, were elected Councilors: Frank Baker, Henry P. Bowditch, A. F. Chamberlain, Stewart Culin, Livingston Farrand, J. Walter Fewkes, Alice C. Fletcher, J. N. B. Hewitt, Walter Hough, Alés Hrdlicka, A. L. Kroeber, George Grant MacCurdy, O. T. Mason, Washington Matthews, J. D. McGuire, James Mooney, W. W. Newell, Frank Russell, M. H. Saville, Harlan I. Smith, Frederick Starr, John R. Swanton, Cyrus Thomas, and E. S. Wood.

The Association arranged to hold the next regular meeting at Washington, in connection with the meeting of the American Association for the Advancement of Science during Convocation Week, 1902–03.

A session for the representation of scientific papers was held jointly with Section H, as already reported in SCIENCE.

The following preamble and resolutions were adopted:

"WHEREAS, The Second International American Conference, commonly known as the Pan American Congress, in session duly assembled in the City of Mexico, January 29, 1902, adopted a recommendation to the several American nations participating in the Conference, that an 'American International Archæological Commission' be created, to promote archeological research, to aid in the preservation of antiquities, and to endeavor to establish an American International Museum; and

WHEREAS, The recommendation is in full accord with the spirit and objects of American science; therefore

"*Resolved*, That the American Anthropological Association heartily concurs in the recommendation of the Second International American Conference.

"*Resolved further*, That the Secretary of the Association send a copy of these Resolutions to the Director of the Bureau of American Republics as an expression of the judgment of the Association."

Undoubtedly the founding of the new association will meet a need long felt by the anthropologists of the United States; it was indeed the consummation of a movement started in 1896 when the Anthropological Section of the American Association for the Advancement of Science began holding winter meetings. The action at Pittsburgh was especially notable for the unanimity shown by the representatives of all sections of the country. Most of the leading anthropologists of America were present in person; and it may be said that all were in some way represented.

It rarely happens that a scientific organization of national character is instituted with so general support and so complete harmony as was displayed at the founding of the American Anthropological Association.

W J M.

DISCUSSION AND CORRESPONDENCE.

BLUE FOXES ON THE PRIBYLOF ISLANDS.

THE account of the 'Blue Fox Trapping on the Pribylof Island,' by Lembkey and Lucas in SCIENCE, Vol. XVI., pp. 216–218, is highly interesting in many respects, but while the authors seem to regard the experiment of sparing the females as of doubtful success, I am of the opinion that the result has amply justified it.

It is quite true that the table of foxes trapped on St. George Island, 1897–1901 (p. 216),* apparently indicates a surprisingly small increase in the females caught, but several causes have probably conspired towards this result. In the first place, the experience on the Commander Islands seems to indicate that the females are more cautious than the males and are not so easily caught. Thus in 1896 there were taken in steel traps on Copper Island 515 males and 452 females or 63 males more than females. If this represents the normal ratio between the sexes caught then it will be seen that on St. George Island in 1900–1901 there should have been taken only 539 females to 614 males under normal circumstances. As 690 females were really taken it would seem that the normal excess of females was 151 instead of 76.

It will be observed that during the previous three years a large number of females have been trapped on St. George Island, which were released after having been 'marked' or 'branded.' Is it quite probable that all these females have allowed themselves to be caught over and over again? The blue fox is a stupid creature compared with his red brother, and I know that the same animal has repeatedly been trapped. But from this to conclude that all the females are thus caught and that none of them have learned by experience to keep out of the traps seems little probable, especially if it is true that the females are more cautious than the males. It appears to me even highly probable that a large number of the females avoided being taken again, and that we have here a valid explanation of the comparatively low number of females in the table on p. 216.

The writers of the article in question think it probable 'that there has been some slight gain in the number of foxes.' Apart from the above considerations I think it can be shown that the gain has been great and almost unexampled.

Statistics covering a long period of years (1847–1891)* show that on the Commander Island,† as a rule the successful fox hunt of one season is followed by a tremendous drop in the yield during the next year. Thus on Bering Island the number of foxes killed in 1852 was 1,900; in 1853 the number dropped to 547, or more than two thirds. In 1859 the harvest was 1,233 foxes, while in 1860 only 584 were caught. In 1871 870 blue foxes were killed, in 1872 only 580. In 1875, 1,087, in 1876 only 573. In 1881–2 the number was 1,477, in 1882–83 only 872. A series of figures such as we have them from St. George for three consecutive years, viz., 867, 955, 1,304, is therefore highly encouraging.

It is therefore greatly to be hoped that the authorities on the Pribylof Islands may not lose heart even if the actual returns may not come up to the figures of the table which is intended to show what the increase ought to be theoretically. It is evident that we do not

* 1902 in the table quoted is probably a misprint for 1901.

* See my 'Asiatic Fur Seal Islands,' 1898, p. 43.

† A corresponding table relating to the Pribylof foxes during part of the same period ('Fur Seals and Fur Seal Islands N. Pacif.,' III., 1899, p. 340) taken from I. Petroff's census report does not show similar conditions on the Pribylof Islands. Without knowing the source of these statistics this difference is not easy to explain, but I would suggest that the list in question may only be a record of the number of skins *shipped* during the respective years but not showing the number of foxes actually killed in the year to which they are credited. The company probably required a certain number of skins shipped each year to satisfy the demand of the market, hence the remarkable uniformity.

know as yet all the factors involved in the problem, but considering the relative scantiness of the food supply on the island at the present it is safe to say that the experience thus far gained speaks in favor of continuing the policy of sparing the female fox.

LEONHARD STEJNEGER.

U. S. NATIONAL MUSEUM,
August 11, 1902.

TYPES VERSUS RESIDUES.

TO THE EDITOR OF SCIENCE: My recent note under the heading 'Zoological Nomenclature in Botany' was not intended as a contribution to a running controversy, but was merely a plea of 'not guilty' to the horrible charge of having continued in botany the discussion of a tiresome question solved long ago in zoology. Historical differences in the development of the two biological sciences were taken to be at least a partial explanation of the fact that zoologists had managed, though not without considerable effort of casuistry, to keep their barge afloat in spite of shoals which would bring the more heavily laden botanical craft firmly aground. That the framers of the zoological chart to which botanists had been referred had not sounded all the difficulties of the problem of nomenclatorial stability is rendered even more obvious by Dr. Dall's two letters.*

It is not to be expected that the merits of any suggestion in so old and intricate a subject as nomenclature can be made plain by desultory argument, but the possibility that somebody may wish to examine the matter further may justify the notice of such of the new specifications of the second letter as seem calculated to obscure the question of permanent generic types. I am quite unable to understand why Dr. Dall should represent me as objecting to 1758 as the initial date for zoological nomenclature, or as favoring vernacular names.

Under the method of types systematists who agree to the validity of a generic group will not differ as to the name to be applied to it, while under the method of elimination such differences are frequent and necessary. This absurd provision for perpetual confusion has appeared unavoidable to DeCandolle and to many eminent systematists of later date because they persist in the pre-evolutionary fallacy of regarding genera as definitions or concepts instead of taking advantage of the evolutionary right to treat them as groups of species, to one of which the generic name may be as directly and fixedly attached as the specific name itself. And since by means of an evolutionary axiom we can escape the Doubting Castle of mediæval casuistry and much unproductive labor of antiquarian research, Dr. Dall's objection to so simple and practical an expedient can scarcely be understood except as an unwillingness to come out—a nomenclatorial Prisoner of Chillon, as it were.

To attach generic names to type species certainly renders nomenclature far more effectively separate from classification than when they are made to pertain only to residues which vary with every individual opinion. Taxonomy as a whole is, however, but a means for scientific ends, and is not studied merely to preserve the Linnæan or the DeCandollean traditions. The taxonomic problems of to-day are very different from anything contemplated by Linnæus, and if the system of nomenclature popularized by him could not be modified to serve practical purposes it would undoubtedly be discarded, as occasionally threatened already by physiologists and ecologists impatient at once of the complexity of organic nature and the fickleness of systematists.

To have types for 'modern genera' will yield no 'definite stability' while the ancient names are free to roam over the face of nature, though to tether each of them securely in a particular place must disappoint all except one of the claimants for possession. Nevertheless it would seem that those who have made hundreds of changes of names in accordance with rules which do not produce stability are scarcely in a position to object to measures better calculated to secure permanence.

The only 'upsetting' advocated in this connection is that of a rule which causes, perpetuates and legalizes confusion and instabil-

* SCIENCE, N. S., XV., 749, May 9, 1902; XVI., 150, July 25, 1902.

ity in the application of generic names. The changes incident to the execution of such a reform are few and harmless in comparison with those perpetually necessary where names depend on residues. An excellent example of the workings of the method of elimination is appropriately revealed in the mazes of the recent *Mephitis-Chincha-Spilogale* discussion. Several prominent zoologists propose to settle this by a new rule* which eliminates elimination and yields definite types for a very small percentage of genera, but which constitutes a significant admission of the essential instability of residues. The new rule leads in the right direction, though it is but a short step on a long journey.

Obviously, the method of elimination lacks the definite and 'necessarily arbitrary' features without which, as Dr. Dall well says, 'stability is hopeless.' It may be true that the zoological laws 'are intended to * * * bring about stability,' but it is plain that the intention has not been rendered effective by adequate formulation. Systematists who appreciate stability may differ on details of the legislation needed to inaugurate the method of types, but they should not use stability as an argument for residues.

O. F. Cook.

Washington, Aug. 7, 1902.

SHORTER ARTICLES.

NATURE OF THE SPECIFIC BACTERIAL TOXINS.†

After it had been demonstrated beyond any controversy that certain bacteria cause certain diseases, quite naturally the question was asked, How do bacteria cause disease? Several answers to this question have been offered. If the liver, spleen or kidney of a guinea-pig which has died from experimental anthrax be sectioned and examined under the microscope, the blood vessels of these organs will be found to be filled with bacilli. In many places the germs have grown so abundantly that they distend the smaller vessels. It was suggested that the anthrax bacillus causes disease and death by mechanically interrupting the functions of certain organs. This is known as the mechanical interference theory. It has no support in any other disease than anthrax, and consequently it cannot be accepted as a satisfactory answer to the question, How do germs cause disease? Another theory offered supposes that the bacteria cause disease by consuming the proteids of the body and thus depriving it of its sustenance. It is known that the proteids are necessary for the building up of cells, and it is also known that microorganisms feed upon proteids. This theory is untenable in the first place because many of the infectious diseases destroy life so quickly that the fatal effects cannot be presumed to be due to the consumption of any very large amount of proteid substance. Secondly, the distribution of the germs in the body is such in many diseases that they do not come in contact with any large percentage of the proteids of the body, and thirdly, the symptoms of the majority of the infectious diseases are not those which would be produced by withdrawing from the various organs their food supply. A third theory supposed that the germs cause the symptoms of the disease and death by depriving the red blood corpuscles of their oxygen. This theory was suggested by the resemblance between the symptoms of anthrax and those of carbon dioxide poisoning. More extended observation soon demonstrated the fallacy of this theory, especially inasmuch as it was shown that the amount of physiological oxidation going on in the bodies of animals sick with anthrax was not diminished by the disease. In this way the theory that germs destroy life by depriving the blood of its oxygen has been shown to be not applicable to anthrax, and in fact not to any known infectious disease. Next it was suggested that bacteria cause disease by forming chemical poisons. This is the theory which has found general acceptance and which is now generally believed to be the true explanation, although none of the specific toxins has been isolated in a state of chemical purity. The elaboration of chemical poisons by bacteria may occur in either of two ways: In the first place the bacterium, either

* Science, N. S., XVI., 114, July 18, 1902.

† Abstract of a paper presented by Dr. V. C. Vaughan before the Research Club of the University of Michigan.

acting as a ferment, or by forming some soluble enzyme, may split up the proteids or other constituents of the body or of the artificial culture medium, and among these split products poisons may be produced. In this way the formation of the specific toxins would be an analytical process. In confirmation of this theory, highly poisonous bodies have been found in artificial culture media of some of the pathogenic bacteria. Some of the first of these poisonous bodies found were basic in character and were known as ptomains, which is a designation given to putrefactive alkaloids. Many chemists have sought diligently among the basic products of putrefaction for the specific toxins of the infectious diseases, and while a few highly poisonous ptomains have been found, it is safe to say that no one has yet been discovered to which all the symptoms and lesions of a disease could be attributed. The researches of Roux and Yersin, followed by those of Brieger and Fraenkel, on the diphtheria toxin, led to the conclusion that the specific poisons, instead of being basic in character, are modified proteids, and to these the term toxalbumins has been given. However, competent workers have failed to find anything like toxalbumins in cultures of many of the most virulent pathogenic bacteria. Anthrax is a disease to which all of these theories concerning the *modus operandi* of bacteria have been referred, and although Brieger and Fraenkel thought at one time that they had found a specific toxalbumin in the bodies of animals dead from anthrax, more careful investigations by other chemists have failed to confirm their results, and it is safe to say to-day that no specific bacterial toxin has been found either in the body after death from an infectious disease, or in artificial culture media; at least, no substance belonging to this group of bodies to which the symptoms and lesions of the disease could be attributed. The other possible explanation of the production of chemical poisons by pathogenic bacteria is that these substances are formed by synthetical processes and are built up in the cells of the microorganisms. The problem which Dr. Vaughan and his students have attempted to solve was that of determining whether or not the cells of pathogenic bacteria contain specific toxins. By means of the large incubating tanks, devised by Dr. Vaughan, and which have been described in SCIENCE on page 378 of the issue of March 7, 1902, the cellular substance of the pathogenic bacteria has been obtained in large amount. The first experiments were made with the colon bacillus. A virulent form of this germ was first grown in ordinary beef tea cultures at 37° for periods varying from fifteen to thirty days, and shown to be toxic in both sterile and unsterilized conditions, provided that the sterilization was accomplished by means of heat, but when the beef tea culture was deprived of germs by filtration through porcelain, the germ-free filtrate could be injected into guinea-pigs in amounts of from eight to ten cubic centimeters without any other harm than that which would result from the introduction of an equal amount of sterile beef tea into the abdominal cavity of an animal. It follows from this that in the colon bacillus at least there is no soluble toxin formed. However, when the germ substance was obtained in large amount, free from constituents of the culture medium, extracted with alcohol and ether, dried and pulverized, and injected into animals in doses of from one to five milligrams, death resulted. This shows that the bacterial cell contains a toxin. In case of the colon bacillus the bacterial cell suspended in water and placed in a sealed tube may be heated in 180° C., for half an hour without loss of toxicity. Various attempts were made to extract the toxin from the cell by physical means. All kinds of solvents, including various salts of different strengths, were tried, without effect. These investigations led to the belief that the specific toxin of the colon bacillus is an integral part of the cell, and consists of a molecular group of the cell proteid. It was then found that when the dried colon cell substance was heated at the temperature of the water bath for a period not exceeding thirty minutes with one-per-cent. aqueous solution of sulphuric acid a certain constituent of the cell was split off by this process and passed into solution. The acid extract when filtered through porcelain or hard paper yields a voluminous pre-

cipitate when poured into three volumes of absolute alcohol. This precipitate, when collected, thoroughly washed until wholly free from acid, dried and pulverized, induces, when injected into animals, the symptoms and lesions of colon intoxication. So far this method of extracting the cellular toxins has been applied to the colon bacillus, and the bacilli of anthrax and diphtheria. These pathogenic organisms have all yielded, when treated with dilute sulphuric acid, toxins which, when injected into animals either subcutaneously or intraperitoneally, induce the symptoms and lesions which follow inoculation with virulent living cultures. The space limitation has already been exceeded, and we will have to omit a discussion of the properties of these intracellular toxins.

A BACTERIAL SOFT ROT OF CERTAIN CRUCIFEROUS PLANTS AND AMORPHOPHALLUS SIMLENSE.*

For several years the writers have had under observation a soft rot of certain cruciferous plants, particularly cabbage and cauliflower. During epidemics of black rot, *Pseudomonas campestris* (Pam.) Smith, in both cabbage and cauliflower it often happens that much damage is done by a soft rot. At first this soft rot was supposed to be merely a virulent form of black rot; but it was found that severe attacks of soft rot may occur in fields where there is little or no black rot. Especially is this true of seed cabbage. On Long Island the production of cabbage seed is an important industry, and one of the chief enemies to the crop is a soft rot which attacks the plants during winter storage in trenches and also at the time of blooming. In storage the plants are attacked just below the head. In the field this portion of the stem rots, causing the plant to suddenly wilt and die while in bloom.

In the cauliflower fields on Long Island one may find at any time during August, September and October plants which have suddenly collapsed with soft rot of the stem. From a plant thus affected the writers, in September, 1901, isolated an organism which in their notes was designated 0.2 E. Pure cultures of this organism were inoculated into cabbage and cauliflower plants in pots in the greenhouse in the following manner: A leaf springing from the fleshy portion of the stem was cut off close to the stem with a sterilized scalpel. Through the sterile surface thus formed the stem was punctured to the center by means of a needle which had been first sterilized and then dipped into a fresh culture of the organism. Finally the wound was smeared over with melted grafting wax. In this manner numerous plants of cabbage and cauliflower were inoculated at various times between March 10 and June 17. With one exception all of these plants became much rotten at the point of inoculation, whereas in the same number of check plants none showed any rot or discoloration whatever. The extent of the rotting seemed to depend largely upon the condition of the plant. On thrifty young plants it progressed with wonderful rapidity. Thrifty cabbage plants, two months old, nine inches high and with stems of the size of a lead pencil were so much rotted at the end of forty hours after inoculation that their own weight caused them to break over at the point of inoculation. On old, woody, slow-growing plants unmistakable signs of rot appear in from two to four days after inoculation; but in the majority of cases such plants are only checked in growth and not killed outright.

In most cases the rot first appears as a slight discoloration around the point of inoculation, works very rapidly for a few days, then stops. At first the rotten tissue is soft and mushy and watersoaked in appearance, but it soon dries and mostly disappears, leaving only a cavity lined with shreds of dry, blackened tissue.

Cabbage and cauliflower leaves inoculated in the petioles usually become broken over and soft rotten at the point of inoculation within forty-eight hours. Inoculations made in the blade of the leaf produce no marked results unless a large vein is punctured, in which case soft rot follows as with petiole inoculations. However, on the leaves of plants under bell-jars circular, dead, brown spots sometimes

* A preliminary report read before Section G of the A. A. A. S. at Pittsburgh, Pa., June 30, 1902.

appear in the parenchyma around the points of inoculation. Inoculations on the heads of cauliflower plants under bell-jars bring about an active soft rot which in a few days involves the whole head.

Young plants of kohlrabi and Brussels sprouts were caused to rot by inoculation in the stem, rutabagas by inoculation in the leaf petioles and radish and flat turnip by inoculation in the fleshy root.

Ten seed cabbages in full bloom and growing in the open air were inoculated with a pure culture by making a puncture in the enlarged portion of the stem where the head was originally attached. The wounds were covered with grafting wax. There were ten check plants. On the eighth day after inoculation three plants died from soft rot at the point of inoculation. None of the check plants were affected. Since May 28, when these plants were inoculated, there has been but a single shower upon them. This, coupled with the prevailing low temperature, may explain why more have not yet died.

The organism was also tested on slices of uncooked carrot, turnip, potato, onion and parsnip. Within twenty-four hours there were large areas of soft rot around the points of inoculation on all of these vegetables. Up to this time the organism was supposed to be different from *Bacillus carotovorus* Jones because it rots cabbage and cauliflower with avidity, whereas Jones states* specifically that *B. carotovorus* is without effect when inoculated on cauliflower; but the behavior of 0.2 E on uncooked vegetables aroused the suspicion that it might, nevertheless, be related to *B. carotovorus*. Accordingly, an authentic culture of *B. carotovorus* was obtained from Professor Jones and inoculated into cauliflower and cabbage plants. There followed a virulent soft rot strikingly like that caused by 0.2 E. The two organisms were then grown in parallel cultures on various culture media and found to behave in about the same way. Thus it appears highly probable that the germ 0.2 E is closely related to, if not identical with, *Bacillus carotovorus* Jones.

Besides 0.2 E there have been isolated several other similar organisms which produce soft rot when inoculated into cabbage and cauliflower plants. Two such germs were obtained from rutabagas affected with a destructive soft rot in a garden at Phelps, N. Y., in 1901; one from stored cabbages on Long Island; several from seed cabbage plants dying with stem rot while in bloom; and two from *Amorphophallus simlense*, a member of the Araceæ cultivated by florists. Since 1897 the writers have each year observed a destructive soft rot which attacks the petioles of *A. simlense* during June and July and causes the death of many leaves. The petioles of this plant are often two feet in length, an inch in diameter at the base and very juicy. The bacterial nature of this disease has been proved by inoculation experiments made in 1897, 1900 and 1901. Quite recently the *Amorphophallus* germs have been compared with 0.2 E and the other cabbage rot organisms and found to agree very closely with them. The *Amorphophallus* germs inoculated into cabbage plants produce soft rot and 0.2 E, and the germs from rutabaga when inoculated into *Amorphophallus* produce a soft rot of that plant.

Thus we have several bacterial forms which produce a violent soft rot of cabbage, cauliflower and several other crucifers and at least four of them also attack *Amorphophallus simlense*. It is likely that the list of host plants, and, perhaps, also the number of organisms, will be enlarged by future studies. The relationship of the various forms has not been fully worked out, but the present indications are that we have here to do with a group of organisms closely related to each other and to *Bacillus carotovorus* Jones, but presenting certain minor differences which may cause them to rank as varieties of *B. carotovorus* or, possibly, as separate species.

When completed, a full account of this investigation will be published in a bulletin of the New York Agricultural Experiment Sta-

H. A. HARDING,
F. C. STEWART.

* Jones, L. R., 'A Soft Rot of Carrot and Other Vegetables.' *Ann. Rep. Vermont Exp. Sta.*, 13: 310, 1900; also, *Centralbl. f. Bakt. Parasitenk. u. Infektionskr.*, II. Abt., 7: 15.

NOTE ON THE MULTIPLE IMAGES FORMED BY TWO PLANE INCLINED MIRRORS.

Having noticed errors in the statement of the number of images in a couple of text-books, I have recently made a canvass of forty-one books on optics or general physics, and was surprised to find a general lack of information on this subject. Fifteen of the books did not consider it at all, many of the others took up only special cases where the angle is 60° or 90°, and eight contained misstatements as to the number of images. It does not seem to be generally recognized that the number of possible images depends upon the position of the object, and that the number of these which are visible depends upon the position of the observer's eye. As in only five of the forty-one books examined was the dependence of the number of images upon the position of the object correctly stated, I have thought it well to write out the following analysis.

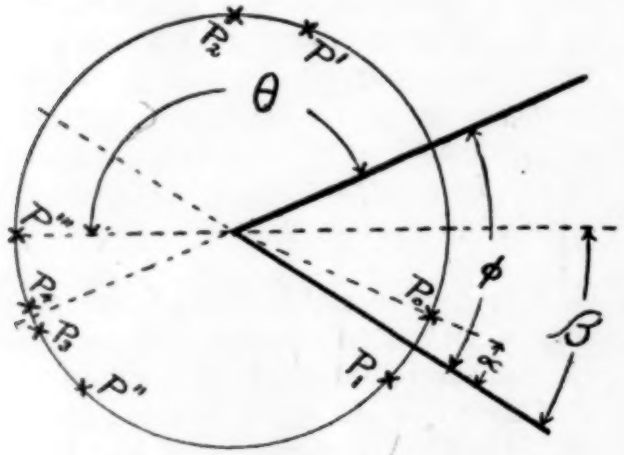

Fig. 1.

Let φ be the angle between the mirrors, a the angular distance of the object P_0 from one of them, P_1, P_2, etc., the images formed by first reflection in the latter, P', P'', etc., the images formed by first reflection in the other mirror. Then, if n be a whole number, the angular distance from P_0 to any image may be stated as follows:

P_{2n}	$2n\phi$
P_{2n+1}	$2n\phi + 2a$
P^{2n}	$2n\phi$
P^{2n+1}	$2n\phi + 2(\phi - a)$

If the p-th image fall behind both mirrors in set P_{2n}

$$\pi + \phi - a > 2n\phi > \pi - a$$

in set P_{2n+1}

$$\pi + a > 2n\phi + 2a > \pi - \phi + a$$

or

$$\pi + \phi - a > (2n+1)\phi > \pi - a$$

These conditions are the same and may be written

$$\pi + \varphi - a > p\phi > \pi - a$$

or

$$\frac{\pi - a}{\phi} + 1 > p \geqq \frac{\pi - a}{\phi}$$

where the equality sign is brought in so that p may represent the number of images in this set as well when the last one falls on the line of one of the mirrors.

Similarly, if the r-th image fall behind both mirrors in set P^{2n}

$$\pi + a > 2n\phi > \pi - \phi + a$$

in set P^{2n+1}

$$\pi + \phi - a > 2n\phi + 2(\varphi - a) > \pi - a$$

or

$$\pi + a > (2n+1)\phi > \pi - \phi + a$$

Hence

$$\frac{\pi + a}{\phi} > r \geqq \frac{\pi + a}{\phi} - 1$$

and the total number of images $= k = p + r$. If φ divide evenly into π, $p = r = \pi/\varphi$ and the last images of the two sets coincide. Then

$$k = p + r - 1 = \frac{2\pi}{\phi} - 1,$$

and k is independent of a.

This much is correctly worked out in Violle, Heath and several smaller works on optics, but in no text on general physics in English that I have seen.

If the eye be behind the plane of one mirror, only the images finally formed by the other are visible. If the eye be between the mirrors (angularly) all the images formed in front of either mirror are visible. An image behind both mirrors will be visible only to an eye between the mirrors whose position makes an angle less than $\pi - \theta$ with the surface in which the last reflection takes place, where θ is the angle between this surface and the position of the image considered.

A few examples may make the subject more clear.

If $\phi = 72°$, $a = 36°$; then $p = 2$, $r = 2$, $k = 4$,

and all the images are visible to an eye anywhere between the two mirrors.

If $\phi = 72°$, $a = 10°$; $p = 3$, $r = 2$, $k = 5$,

but only three of the five images will be visible to an eye placed within 25° of the mirror furthest from P_0.

If $\phi = 55°$, $a = 25°$; $p = 3$, $r = 3$, $k = 6$.

If $\phi = 55°$, $a = 10°$; $p = 4$, $r = 3$, $k = 7$.

If the eye be placed within the angle β only five of the seven images are visible. This is the case shown in the figure.

It is interesting to observe the results experimentally and see one of the images disappear or merge into another at critical angles. For $\varphi = 55°$, a critical case is given by $a = 15°$.

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THE PLANET EROS.

THE planet Eros, as we noted last week, was rediscovered on the morning of August 2 by Dr. Chas. J. Ling with the twenty inch refractor of the Chamberlin Observatory at University Park, Colo. It was found pretty close to the place derived from an ephemeris computed by Miss Mary Clark Traylor. But it was estimated to be considerably brighter than had been expected. In view of the fact that the law of its variability is unknown the results of photometric measures will be awaited with interest. As Eros is now low in the east when the morning twilight begins, and is advancing in right ascension nearly as fast as the sun, it will not be an easy object for some months to come. The position on August 11 at $15^h\ 25^m\ 19^s$ Univ. Park M. T. was

AR $5^h\ 36^m\ 35.03^s$.
Decl. $+31°\ 56'\ 17.7''$.

THE MARINE BIOLOGICAL LABORATORY AND THE CARNEGIE INSTITUTION.

AT a meeting of the corporation of the Marine Biological Laboratory held at Woods Hole on August 12, it was voted to transfer the laboratory and its equipment to the Carnegie Institution. This action was taken after it had been stated to the members of the corporation that the executive committee of the Carnegie Institution would recommend to the trustees that the laboratory should be accepted, that its debts should be paid, that new buildings should be erected, that $20,000 a year should be allowed for maintenance and that the scientific management should rest as heretofore with the naturalists of the country. A motion that a three fourths vote of the members present be required for the transfer of the property of the corporation was defeated by a vote of 32 to 19. It was voted without dissent that an account of the action of the corporation be made public.

SCIENTIFIC NOTES AND NEWS.

DR. N. L. BRITTON sailed for England on August 16, where he will complete some investigations upon American *Carices* and *Crassulaceæ* which will be issued as the first parts of the 'Systematic Botany of North America' to be published by the New York Botanical Garden. Dr. MacDougal will be acting director of the garden during his absence.

PROFESSOR J. E. WOLFF, of the U. S. Geological Survey, is continuing the investigation of the areal and structural geology in the crystalline areas of New Jersey, in cooperation with the state geologist.

DR. ROBERT BELL, of the Geological Survey of Canada, has been engaged in the geological survey of Baffin Land, which he finds to have an area of about 300,000 square miles, making it the largest island with the exception of Australia and Greenland. The results of Dr. Bell's explorations are to be presented to the Royal Geographical Society.

MR. BORCHGREVINK, the Norwegian explorer, has taken out naturalization papers, so as to Americanize the Antarctic expedition he is planning under the auspices of the National Geographical Society.

MEDICAL exchanges state that the committee of the Liverpool School of Tropical Medicine is making arrangements to enable Major Ron-

ald Ross to proceed to Ismailia next September, to start an organized campaign against malaria, in consequence of an urgent request from the president of the Suez Canal Company that the Liverpool School of Tropical Medicine assist in a concerted effort to cope with the prevalence of malaria.

The Bisset Hawkins gold medal of the Royal College of Physicians of London, conferred triennually for advancing sanitary science, has been awarded to Dr. W. H. Power, F.R.S., principal medical officer to the local government board.

Professor A. W. Evans, of Yale University, and Mr. Percy Wilson, of the New York Botanical Garden, have returned from a tour of exploration of the mountains of Porto Rico carried out under the auspices of the New York Botanical Garden. A large quantity of valuable material, including living and preserved specimens, was secured.

Mr. William C. Mills, curator and librarian of the Ohio State Archeological Society, is at present directing field explorations near Chillicothe, Ohio. The party has completed the exploration of the noted Baum village site and is now exploring the Gairdner mound, which is situated near the Cedar Bank Works. Many skeletons are being found and they are close together. Bone implements and ornaments are also numerous.

Dr. Frederick H. Baetjer, assistant resident physician at the Johns Hopkins Hospital, has been sent to Europe by that institution to study for one year the x-ray treatment of cancer.

Lieutenant Richard Strong, of the Army Medical Corps, is studying the cholera bacillus in the laboratories established by the Bureau of Insular Affairs in the Philippines.

Dr. T. O. Jaggar, of Harvard University, who has recently returned from investigating the volcanic eruptions at Martinique and St. Vincent, has given a lecture on the subject at Harvard University.

Dr. J. F. Newsom, professor of mining in Stanford University, goes to Europe in September and will return to his university work in January next. He expects to visit the principal mining districts and mining schools of Great Britain and the continent during his absence.

Dr. Frederick Bedell, assistant professor of physics in Cornell University, returns early in September after a Sabbatical year in Europe.

George F. Sever, adjunct professor of electrical engineering at Columbia University, has been appointed a consulting electrical engineer in the New York City Department of Water Supply, Gas and Electricity.

Professor D. J. Cunningham, F.R.S., will give before the Anthropological Institute of Great Britain and Ireland the third annual Huxley memorial lecture on October 21, his subject being 'Right-Handedness and Left-Brainedness.'

Dr. David Ferrier, F.R.S., will deliver the Harveian oration before the College of Physicians, London, on October 18. The Bradshaw lecture will be delivered in November by Dr. C. J. Cullingworth. Dr. A. S. F. Grünbaum has been appointed Goulstonian lecturer and Dr. T. R. Glynn Lumleian lecturer for 1903, and Dr. J. R. Bradford the Croonian lecturer for 1904.

Those interested in hydrotherapeutics are asked to contribute toward a monument to Priessnitz, the father of hydrotherapy, to be erected at Vienna. Contributions can be sent to Professor Chrobak.

Charles W. M. Black, assistant professor of mathematics in the University of Oregon, has died in La Grange, Oregon, of consumption. He was on his way to Colorado, where he hoped his health would be benefited.

The death is also announced of Dr. Cesare Taruffi, professor of pathologicai anatomy at Bologna.

It is announced that Professor Joseph Seegen proposes to offer a prize under the auspices of the mathematical and natural science class of the Imperial Academy of Sciences, in Vienna, for th best answer to the following question, 'Is any part of the nitrogen of the albuminates which have undergone metabolism in

the animal body eliminated either by the lungs or by the skin in the gaseous form?' The value of the prize is 6,000 kronen, about $1,000. The essays may be written in German, French or English, and must be sent in before February 1, 1904.

MEDICAL journals state that a prize of 500 lire is offered by the Societa Medico-Chirurgica of Bologna for the best work received before 1903 on the subject of 'Serum Diagnosis of Tuberculosis.' All competing communications must be addressed to the secretary of the society, and be written in Latin, French or Italian.

THE daily papers report that patents on eleven different parts of wireless telegraphic apparatus were granted on August 12 by the Patent Office to Professor Reginald A. Fessenden of the Weather Bureau.

DEEDS were filed on July 26, at Saranac Lake, transferring 514 acres of land at Ray Brook to the State Hospital Commission. This is for the state sanatorium for the treatment of incipient tuberculosis.

THE *Journal of the American Medical Association* states that the New South Wales branch of the British Medical Association gave a conversazione at the University of Sydney, June 24, including among the guests government officials and members of parliament, foreign consuls and ministers. An exhibit included pathologic models and specimens, old books, electric devices with demonstrations, chemical and biologic apparatus.

THE first international conference to discuss uniform standards for the stronger drugs of the Pharmacopeia will meet at Brussels on September 15.

A LETTER received on August 14 by the secretary of the Peary Arctic Club from Captain Samuel W. Bartlett of the steamer *Windward*, dated Domino Run, Labrador, July 26, says: "Everything works smoothly, and am in hopes of reaching Etah Aug. 5, and that we shall have no difficulty in crossing Smith Sound and finding Peary. Hope to see you in New York Sept. 20 with the best of news."

THE University of Illinois Biological Station at Winona Lake is closing after a very successful season. The total enrollment is 79, as compared with 58 last summer.

THE topographic survey of North Carolina is being actively pushed during the present season by the United States Geological Survey in cooperation with the state, the state board of agriculture providing half the funds for this work and the federal organization the remainder. The work is under the charge of Topographer Albert Pike, who has several parties now in the field.

WE learn from Symons' *Meteorological Magazine* that Mr. W. H. Dines has been carrying on experiments with his rhomboidal kites at Crinan, in the west of Scotland, during the month of June, and has, it seems, succeeded in obtaining satisfactory meteorological records from heights up to 4,800 feet or more. Mr. John Anderson has been making similar experiments with a bamboo box-kite at Millport.

THE Civil Service Commission announces that on September 9 an examination will be held for the positions of pathologist and bacteriologist in the government laboratories at Manila, P. I. The salaries of these positions are $1,800 and $1,500 respectively. On October 21, 22 and 23 an examination will be held for the positions of civil and electrical engineers in the Philippine service, the salaries being $1,400 and $1,600. Appointees will be required to pay their traveling expenses to San Francisco, but the government furnishes them transportation free of charge on its transports from that point to Manila, but exacts a charge of $1.50 a day for meals while en route, which is returned to the appointee upon his arrival at Manila. Employees who are residents of the United States at the time of their appointment shall, after six months' satisfactory service, be reimbursed for their traveling expenses from the place of their residence to the point of embarkation for Manila. Thirty days' leave of absence is granted each year, exclusive of Sundays and holidays, and those employees who are promoted to $1,800 per annum are entitled to thirty-five days, or about forty days, including Sundays and holidays. Leave is also cumulative, and at the end of

three years those who have to their credit cumulative leave for two years may visit the United States without having the time in going to and returning from San Francisco charged against their leave.

UNIVERSITY AND EDUCATIONAL NEWS.

Rutgers College receives $10,000 by the will of the late William Clark.

Mr. George F. McCulloch, president of the Union Traction Company of Indiana, has given $10,000 to the National Technical Institute to be located on the arsenal grounds at Indianapolis.

The corner stone of the new women's building of the University of Texas was laid by Mrs. Sayers, wife of Governor Sayers, on Monday, August 11, in the presence of representatives of the board of regents, the faculty and other prominent citizens. The building is of Austin cream-colored pressed brick with white limestone trimmings. The portion now in the process of erection, about one half, will cost $75,000.

Mr. J. K. Caird, of Dundee, has offered to the council of Dundee University College £13,000 to provide and equip a new physical laboratory.

The University of North Wales has received £2,500 for scientific and technical scholarships to perpetuate the memory of the late Sir G. Osborne Morgan.

It is reported from London that the executors of the will of the late Cecil Rhodes expect that the first scholarships under the terms of the will will be awarded in 1904.

The Czar has ordered the liberation of all the students who were imprisoned at Smolensk in connection with the student disturbances in Moscow last February.

After consultation with Mr. Astor, and in accordance with his wish, the council of University College, London, has resolved to endow the chair of pure mathematics and to name it the 'Astor chair.'

The fifth annual session of the University of Texas summer school opened on July 12, the day following commencement, and closed on July 26. There were courses offered in mathematics, physics, physiography, chemistry, botany, education, history and the languages. The attendance reached 262, the largest of any summer session to date. The management of the school was in the hands of an executive committee consisting of President Prather, Dean Sutton and Professors Garrison, Simonds and Battle.

The south wing of the main building at Iowa State College of Agriculture and Mechanic Arts at Ames was burned on August 14. The wing was to have been torn down to make room for a new building. The valuable botanical collection and equipment were saved.

President Ernest R. Nichols, of the Kansas State Agricultural College, has been elected president of the Rhode Island College of Agricultural and Mechanic Arts at Kingston.

Dr. T. N. Lewis, of Western Maryland College, has been elected president of Adrian College, at Adrian, Mich.

E. W. Rettger, Ph.D. (Clark), and G. O. James, Ph.D. (Johns Hopkins), have been appointed instructors in the department of mathematics and astronomy of Lehigh University.

Mr. John Adams, rector of the United Free Church Training College, Glasgow, and lecturer on education in Glasgow University, has been appointed professor of education in the University of London. The senate of the University has also appointed Dr. Samuel Smiles assistant teacher in organic chemistry at University College and Dr. F. G. Donnon, assistant teacher in general chemistry. The staff of the reorganized department of chemistry of the college, London, will be as follows: General and inorganic chemistry; professor Sir William Ramsay, K.C.B., F.R.S.; assistant professors, Dr. F. G. Donnan, Dr. Morris Travers and Mr. E. C. C. Baly; organic chemistry; professor, Dr. J. Norman Collie, F.R.S.; assistant professor, Dr. S. Smiles.

Dr. Carl Gussenbauer, professor of surgery, has been appointed rector, and Dr. Ernest Ludwig, professor of chemistry, dean of the University of Vienna.